

T E R R A

THE NATURAL HISTORY
MUSEUM OF
LOS ANGELES COUNTY

VOLUME 29, NO.1
FALL 1990





An adult red crab and numerous newly born crabs, all part of the annual Christmas Island breeding migration. The island has issued seventeen crab stamps — see page 8 to find out why.

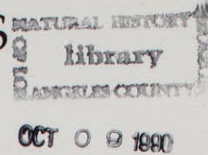
JOHN HICKS

TERRA

THE MEMBERS' MAGAZINE
OF THE
NATURAL HISTORY MUSEUM
OF LOS ANGELES COUNTY

VOLUME 29, NO. 1
SEPTEMBER/OCTOBER/
NOVEMBER 1990

CONTENTS



COVER: This four-inch-high Maya figurine, excavated from Tomb 23 at Río Azul, Guatemala, may depict the noble interred in the tomb. The clay whistle was fashioned some 1,500 years ago. See page 17 for an article by the director of the Río Azul Project on new information on the Maya gleaned from this exciting on-going excavation.

GEORGE MOBLEY ©NATIONAL GEOGRAPHIC SOCIETY

DIRECTOR

Craig C. Black

CHIEF DEPUTY DIRECTOR

Mark A. Rodriguez

LOS ANGELES COUNTY

BOARD OF SUPERVISORS

Peter F. Schabarum, Chairman, First District

Deane Dana, Fourth District

Kenneth Hahn, Second District

Edmund D. Edelman, Third District

Michael D. Antonovich, Fifth District

HEAD OF PUBLICATIONS

Robin A. Simpson

EDITOR

Kathy Talley-Jones

ASSOCIATE EDITOR

Harry J. Pack

EDITORIAL BOARD

Craig C. Black / Daniel M. Cohen / Janet R. Fireman /

Joan Grasty / John M. Harris / Peter C. Keller / William

A. Mingst / Harry J. Pack / Mark A. Rodriguez

Robin A. Simpson / Kathy Talley-Jones

DESIGN

Armin Krumbach

MUSEUM PHOTOGRAPHERS

Dick Meier / John De Leon / Don Meyer

ADVERTISING SALES REPRESENTATIVE

Western Media Sales

50 West Hillcrest Drive, Suite 215

Thousand Oaks, CA 91360

Telephone: 805 / 496-3500

Fax: 805 / 496-3522



TERRA is published by the Natural History Museum of Los Angeles County and is sent as a benefit to museum members. Single copy price: \$4. Subscriptions: \$14 per year. For membership information, visit the Membership Office at the Natural History Museum or call 213/744-3426. All other inquiries can be referred to the Publications Office, Natural History Museum, 900 Exposition Boulevard, Los Angeles, CA 90007. Printed by North Hollywood Printing Co., Inc. Color separations by Goody Color Separations. Typography by Continental Typographics. All Rights Reserved. Reproduction in whole or in part without permission is prohibited. ISSN 0040-3733

©1990 Natural History Museum Foundation

Museum on the Move	4
The Crabs and Crab Stamps of Christmas Island by A. L. Rice and Joel W. Martin	8
The Making of a Natural History Postage Stamp by Wendy Smith-Griswold	13
Salvaging the Past at Río Azul, Guatemala by Richard E.W. Adams	17
The Largest Hotel and Watering Place in the World by Donald Chaput	27
Strangers in Paradise by Wayne P. Armstrong	32
Bugs Bunny by Steve Schneider	42
Focus on Nature	48
Housecalls	50
Book Review	50
Focus on the West	51

**Board of Trustees of the
Natural History Museum
Foundation**

Robert S. Attiyeh
Chairman
Stephen R. Onderdonk
President
Otis Chandler
Vice President
David Comsky*
Vice President
William A. Mingst
Vice President
Charles O. Parker II
Vice President
Mrs. Thomas Reddin
Vice President
Sheldon Richman
Vice President
William R. Zimmerman
Vice President
Richard C. Seaver
Treasurer
Leslie C. Curtis
Assistant Treasurer
Dr. M. Norvel Young*
Secretary
Richard Call, M.D.*
Assistant Secretary
Ed N. Harrison*
*President, Board of
Governors*
Robert V. Adams
Mrs. Jane Boeckmann*
Franklin Otis Booth, Jr.*
Mrs. Raouf Boudjakdji
Neal H. Brockmeyer
Judge Wm. Matthew
Byrne, Jr.**
George V. Caldwell**
Edward M. Carson
James H. Cheney
H. Frederick Christie
Mrs. Arthur L. Crowe
Mrs. Justin Dart**
Ted R. Estrada
Matthew K. Fong*
Albert B. Glickman**
James C. Hankla*
John E. Harrigan
Alex W. Hart**
Dr. Patricia House
Ivan J. Houston
Ray R. Irani
Mrs. Betty O. Irvin*
William M. Marcussen*
Dan L. McGurk
G. Everett Miller**
George C. Page
Robert E. Petersen
Richard J. Riordan
Nelson C. Rising
Joseph Ryan
Marc A. Seidner*
Mynatt Smith*
Mrs. James Stewart
Mae Sue Talley**
Richard S. Volpert*
Frank G. Wells
Barbara White-Thomson
John G. Wigmore*
Gin D. Wong

*Governor
**Emeritus

**Alliance Board of
Directors**

Mr. Neal H. Brockmeyer
President
Mrs. Kenneth Leventhal
Immediate Past President
Robert S. Attiyeh
Walter S. Berkman
William J. Bird
Neal H. Brockmeyer
Bruce R. Byers
Susan Chandler
Judy Cobb
Mrs. Francis L. Dale
Mrs. Robert Feinerman
Justice Ronald M. George
Thomas Hacking
Patricia Herbert
Dr. Patricia House
Marshall I. Kass
Mrs. Lindbergh Kawahara
Carole Sumner Krechman
Dr. Frank Lavac
Ernest M. Lever
Marvin H. Lewis
Mrs. Hugh H. Logan
Patricia Lombard
Alan G. Lowy
Douglas J. MacDonald
Mrs. Maurice Machris
Ray T. McCullough
Mrs. Alden McKelvey
Stephen R. Onderdonk
A. F. Osterloh III
Robert Patterson
Mrs. Dan Pocapalia
Mrs. Thomas Reddin
Rudolph J. Rehm
Sheldon Richman
Mrs. Charles Rinsch
Susan W. Robertson
Mrs. Leon I. Singer
Robert Sloves, M.D.
Shauna Sorensen
Mary R. Spring
Mrs. Irving Stone
Mrs. Arnold Travis
Harry H. Tytle
Beverly Williams
Angela Naskar Wojciechowski
Mrs. Robert Wrede
Lorraine P. Young

EXHIBITION NEWS

SHARKS! FACT AND FANTASY BEGINS NORTH AMERICAN TOUR. The largest and most comprehensive exhibition about sharks ever mounted will begin a tour of North American museums this fall. **Sharks! Fact and Fantasy** opens first at the National Museum of Natural History (Smithsonian Institution) in Washington, D.C., in late October; over the course of the next four years the exhibit will travel to fourteen other museums, including the Bishop Museum in Honolulu, the Denver Museum of Natural History, the Royal Ontario Museum in Toronto, the American Museum of Natural History in New York, and the Indiana Children's Museum in Indianapolis.

Traveling exhibitions of museum materials always present special challenges because objects are very fragile, valuable, or both. Displays are often large and very heavy—but how do you pack jaws of fossil shark big enough to swallow a small car? How do you encase a model of the megamouth shark that is fourteen feet long and five feet wide?

Sharks! Fact and Fantasy has given the museum exhibitions and registrarial crews some unique problems to solve—and they have approached them using creative techniques developed working with the museum's traveling exhibitions (both incoming and outgoing) over the last five years or so, when the museum began its ambitious traveling exhibitions program.

The life-size model of megamouth, for example, is hollow and weighs only 150 pounds (the real shark weighs more than 1,300 pounds). The fins and tail

come off, making it much easier to ship. The *Carcharocles megalodon* jaws are wrapped and securely enclosed within a sturdy frame. Other exhibits are displayed in cases that have wheels so that they can be readily pushed in and out of museum exhibition galleries all over the country. Exhibit installation is aided by detailed written instructions and clearly labeled exhibit components.

Sharks! was made possible by the generous support of the National Science Foundation. The museum gratefully acknowledges the support of the exhibition's national sponsors, Red Lobster Restaurants and the Milken Family Foundations. Educational programming for the exhibition was made possible by the Skirball Foundation, the Confidence Foundation, and the Smith-Welsh Foundation. Additional support was received from Sea World.

**LOS ANGELES COUNTY
GOVERNMENT EXHIBIT.**

Museum members who have occasion to visit the County Hall of Administration will want to drop by the Executive Office of the Board of Supervisors, Room 383, where the History Division has opened a new exhibit. Dr. Craig C. Black, the museum's director, and Board of Supervisors Executive Officer Larry J. Monteilh have agreed that the History Division will maintain a permanent exhibition space in the reception area of the executive offices. Exhibits will change on a regular basis and will deal with some aspect of Los Angeles County or southern California history.

The first exhibit, curated by Dr. Errol Stevens of the History Division and designed by Lauren Tawa of the Exhibits Division, is called **In the Beginning: Early Los Angeles County Government**. The exhibit focuses on simpler days—from about 1850 to about 1870—when county government operated on a much smaller scale. Three areas of county government responsibility (care of the sick; law enforcement; and

MUSEUM ON THE MOVE

the assessor's and recorder's offices) are illustrated with artifacts from the History Division collections. Among the artifacts included are a petition from the Board of Supervisors asking for \$5,000 to aid in maintaining the county hospital, then operated by the Sisters of Charity; a revolver, handcuffs, and billy club of the type used by sheriff's deputies in the mid-nineteenth century; tax assessment books in Spanish from 1853 and 1854—both bearing the name of Antonio Coronel, Los Angeles County's first assessor; and a brand book in which is recorded one of Coronel's cattle brands. Also included is one of Coronel's branding irons. The public is welcome to view the exhibit between 8 a.m. and 5 p.m., Monday through Friday.

HEARST COLLECTION OF NAVAJO BLANKETS TRAVELS TO NATION'S CAPITAL. If you missed seeing *Art from the Navajo Loom: The William Randolph Hearst Collection* while it was on display at the Natural History Museum in 1988, you will have a second chance—that is, if you happen to be in Washington, D.C. this fall. More than fifty blankets and rugs from the Hearst collection will be featured at the Textile Museum; Nancy J. Blomberg, Assistant Curator of Anthropology at the Natural History Museum will be guest curator for this special exhibition.

This exhibition, drawn solely from our anthropological collections, presents both the creative gift of the Navajo weaver as well as the changing history of the Navajo people through the spectacular collection of textiles amassed by publishing mogul William Randolph Hearst. Assembled in the early years of this century, it vividly illustrates the depth and diversity of the Navajo weaver's art from 1800 to 1920.

In conjunction with the exhibition, the Textile Museum and the Smithsonian Resident Associate Program will sponsor "Within the

Rainbow Circle of Earth and Sky: Views of Navajo Art Culture," from October 9 to November 13. Well-known scholars and artists from the Southwest will present slide-illustrated lectures that will give a fascinating portrait of the culture and the art of the Navajo people. Nancy Blomberg will be one of the featured speakers.

The Textile Museum is a private nonprofit institution that focuses solely on the collection, study, preservation, and exhibition of historic and handmade textiles and carpets. It has more than 13,000 holdings representing cultures from around the world. **Art from the Navajo Loom** will be on display until December 30, 1990.

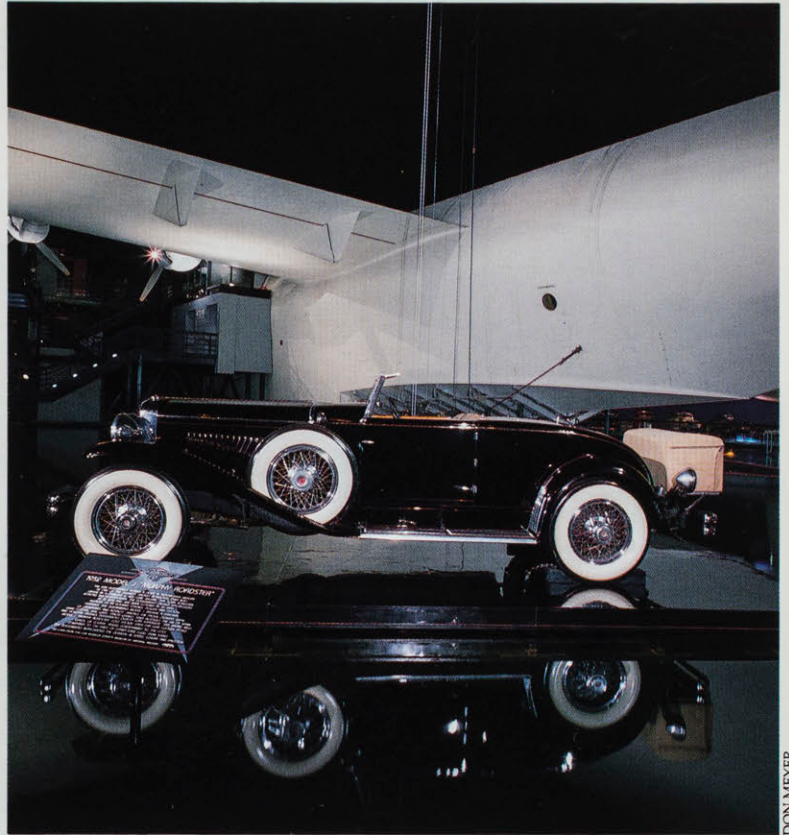
MUSEUM'S DUESENBERG TAKES A VOYAGE. The museum's 1932 Duesenberg roadster was recently placed on temporary display alongside the legendary *Spruce Goose* in Long Beach. The Duesenberg is one of seventy-five vehicles in the museum's collection. The coachwork of the museum's roadster was created at Murphy Body Works in Pasadena, one of southern California's most important custom body producers of the 1930s.

The Natural History Museum is participating with the Walt Disney Company in presenting this automotive classic in conjunction with the current "Voyage to 1939" celebration, which continues until the year's end at the *Queen Mary* in Long Beach.

PUBLICATIONS

MUSEUM TO PUBLISH BAJA CALIFORNIA TRAVELS SERIES. In 1965 editors Glen Dawson, of Dawson's Book Shop in Los

The museum's 1932 Duesenberg displayed with the Spruce Goose.



DON MEYER

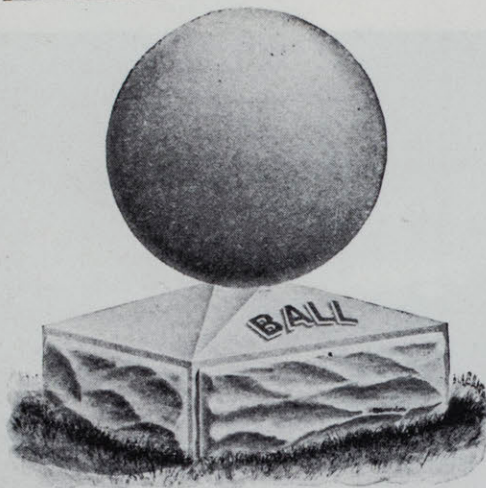
Angeles, and Edwin H. Carpenter, of the Huntington Library in San Marino, initiated a series of fine press books on the history of Baja California. The series featured accounts of travel and adventure on the peninsula that covered the entire historical chronology of the area. Many of the narratives had never before been translated into English; most were available only in manuscript form or in rare book collections prior to publication in this series.

With number 50, publication of the series will be assumed by the Natural History Museum, which published volume 46 in the series in 1982. The museum will continue the fine traditions established by Dawson's Book Shop: in addition to subjects closely related to travel the series will cover the history of natural history, patterns of colonization and settlement, and diverse topics based on peninsular economic, political, and cultural history. Publishing the series

is a natural extension of the museum's publishing program because of the museum's extensive Baja California collections and strong research interest in the area.

In publishing the full breadth and depth of scholarship concerning Baja California, the museum will strive to meet the standards maintained for nearly a quarter of a century by Dawson's Book Shop. For more information on the Baja California Travels Series, please contact the museum's Publications Office, 900 Exposition Boulevard, Los Angeles, CA 90007.

MUSEUM CURATOR RECEIVES DIRECTOR'S PRIZE. Every other year the director of the Natural History Museum presents a \$500 award to the best research paper published by a museum curator. This year Dr. Gordon Hendler, Associate Curator and Head of the museum's Invertebrate Zoology Section, received the



HIGH-CLASS CEMETERY WORK.

It must not be supposed that the illustrations which we publish with our advertisements represent, necessarily, our most admirable designs. The fact is that those we print are intended chiefly as suggestions. We gladly **send** choice drawings, however, on application by those in want of high-class monuments.

All our work is unique in character, being from designs by **our own** artists and sculptors.

Our price is not necessarily the lowest, but we guarantee our figures to be very low for the **exclusively first-quality** work which we do.

We manufacture from Westerly, Quincy, Barre, and all leading granites, and as we **sell direct to consumers**, we **save**

the latter all middlemen's profits. Then, too, there is a decided advantage for the buyer in dealing with **one** responsible firm for **both** the manufacture and the setting of a monument.

All our work is guaranteed, **no charge** being made if not strictly according to contract.

Write us for list of cemetery work erected by us in all parts of the United States and Canada, also for designs and estimates.

THOMAS & MILLER, Quincy, Mass., U. S. A.

THE DEL SUR RANCH CO.

(Incorporated.) Owners of 1440 acres of the best foot-hill

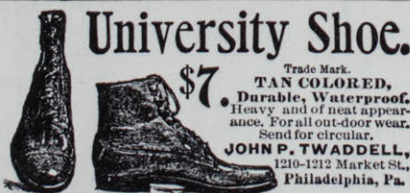
ALMOND LAND OLIVE

in Southern California, will plant for themselves, this winter, from three to four hundred acres to Almonds and Olives. They **will** sell some of their land, plant and care for it until in bearing, on very liberal co-operative terms.

ALMOND EIGHT AND OLIVE TEN SEMI-ANNUAL PAYMENTS.

This makes it easy to acquire a valuable income-producing property. *An income sure to increase with age.* The whole plan is fully explained in a circular to be had free on application to the office of the **RANCH CO., 1227 Trenton Street, LOS ANGELES, CAL.,** or (one of the owners)

GEO. EAKINS, 930 Chestnut St., PHILADELPHIA, PA.
New York, Philadelphia, Pittsburg, and Los Angeles Reference.



A page of advertising from the December 1895 issue of Harper's.

award for "Fine structure of the dorsal arm plate of *Ophiocoma wendti*: Evidence for a photo-receptor system (Echinodermata, Ophiuroidea)," which he coauthored with Dr. Maria Byrne of the University of Syd-

ney in Australia. The paper was printed in *Zoomorphology* (1987).

While it is known that echinoderms (invertebrates such as sea stars, brittlestars, and sea urchins) respond to light, most of them lack discernible eyes. Dr. Hendler's discovery of a light-receptor system in a tropical brittlestar has helped solve the mystery of how members of a major phylum of marine invertebrates sense the differ-

ence between light and dark and day and night.

The brittlestar's seemingly opaque skeleton was found to contain a multitude of microscopic "windows" that transmit light to sensitive nerves within the body wall. In the species studied most intensively, motile pigmented cells associated with the transparent regions regulate the amount of light reaching nerves within the skeleton. The

consequent ability of brittlestars to detect shadows over a range of light levels can enable them to escape from predators, even in coral reef habitats where light intensity changes drastically between day and night. This capability is pivotal in their survival. Interestingly, movements of the light-sensitive pigment cells are manifested by a striking change in the color of the brittlestar as day changes to night. The discovery that brittlestars can indeed change color was first made by Dr. Hendler several years ago, thus the prize-winning study provides an explanation for the mechanism of color change as well as light reception in a widespread but poorly understood group of animals.

This is Dr. Hendler's second Director's Award; in 1987 he received the prize for his paper "The Ploys of Sex: Relationships Among the Mode of Reproduction, Body Size, and Habitats of Coral Reef Brittlestars."

RECENT ACQUISITION

LIBRARY VALUES GIFTS OF ADVERTISEMENTS. Recent gifts to the library have included a donation by Mr. Marvin Walowitz of popular nineteenth- and early twentieth-century magazines, among which was a generous sampling of *Harper's New Monthly*. Although the library already has a complete set of bound volumes of *Harper's*, none of the advertisements remained.

According to Donald W. MacNamee, the museum's Chief Librarian, until early in this century, it was the practice for subscribers to return monthly issues to the publisher, who would exchange them for a bound volume. Unfortunately the publisher trimmed off the advertisements, so fascinating to today's researcher for the

Continued on page 31

Pacific Enterprises

The Pacific Enterprises companies, which include Southern California Gas Company, Thrifty Drug Stores, Big 5 Sporting Goods, and Pacific Enterprises Oil Company

are proud supporters of

The Natural History Museum of Los Angeles County

THE CRABS AND CRAB STAMPS OF CHRISTMAS ISLAND

by A. L. RICE and JOEL W. MARTIN

The Christmas Island Post Office is one of the many postal authorities around the world that unashamedly issues stamps aimed specifically at the philatelic trade. The tiny Indian Ocean island, a speck of coraline rock that juts from the sea and has a population of fewer than 3,000, could hardly expect many of the four or five new sets of stamps issued each year to be used for conventional postal services. Instead, almost all end up in the albums of philatelists, most of whom are topical or thematic collectors, interested in the subjects depicted on the little bits of sticky paper rather than their postal significance.



Many of the stamps that have appeared since Christmas Island began to produce its own issues in 1963 have carried scenes depicting significant events in the island's history. These have ranged from its first recorded sighting in 1615 and its naming by the captain of an East Indian Company vessel on Christmas Day 1643 to its annexation by Britain in 1889 at the height of Victorian gunboat diplomacy, after the recognition of the potential value of its rich phosphate deposits to a fertilizer-hungry world. Other Christmas Island stamps, however, have depicted the island's wildlife, thus tapping the rich vein of interest among topical collectors for stamps illustrating all forms of animals and plants. Among these are the predictable, and philatelically popular, birds, fishes, and wildflowers, but they also include no fewer than seventeen stamps depicting crabs, creatures that are not unknown on the stamps of other postal authorities,

but which are by no means common.

Such an arthropodan preoccupation on Christmas Island is not at all surprising, for there can be few places on earth where crabs adopt a higher profile and may even bring the routine business of human existence literally grinding to a halt—as we shall see.

Somewhat enigmatically, the first “crab” to appear on a Christmas Island stamp, the coconut robber crab, is technically not a true crab at all. The crabs, along with the shrimps, lobsters, crayfish, and their relatives, all belong to the great order Decapoda, meaning “ten-legged” and representing the pinnacle of crustacean evolution. But within the decapods, the shrimps and lobsters are grouped together in a section called the Macrura, meaning “long-tailed,” which refers to the fact that the tail is well-developed and is covered by a more or less hard shell. The true crabs, on the other hand, are in the Brachyura, meaning “short-tailed,” because the tail in these forms is reduced and held folded beneath the rest of the animal's body.

In addition to these two great sections, however, the Decapoda contains a variety of animals in which the tail is neither very large nor very short. Among these so-called anomuran decapods are the familiar hermit crabs of the seashore, which have lost the hard “crustacean” covering from the tail, protecting their posterior instead by threading it down the whorls of an empty snail shell. This shell is then carried about as a mobile home into which the whole animal can withdraw for security at the first sign of danger.



The robber crab is a highly evolved hermit that has given up the shell-carrying habit and has reacquired a hard covering on its tail. By far the largest of all the terrestrial crustaceans, reaching a weight of two kilograms or more, and with an estimated thirty- to fifty-year life span, the robber crab is also the most land-adapted crab and actually drowns after only a few hours in water! Instead, it wanders around many of the islands of the tropical Pacific and Indian Oceans eating virtually anything it can find, including fruit, leaves, carrion, and even other robber crabs. Most of its time is spent on the ground, scavenging for suitable food material fallen from trees and bushes. But it can also indulge in the most uncrablike behavior of climbing trees, reaching heights of many meters to get to particularly succulent fruit. Its common name comes from its supposed ability to open intact coconuts reported, among others, by such an unimpeachable authority as Charles Darwin—though not based on his own observations. The truth of these claims was doubted by scientists for many years, but while robbers will certainly attack cracked and broken nuts if given the choice, recent work suggests that they can, indeed, open intact nuts at a pinch, so to speak.

Over much of its natural range the robber crab is now rather rare, its numbers having been drastically reduced as a result of man's activities. But Christmas Island is a notable exception and supports a large and very active population. Moreover, whereas in most regions the species is rather strictly nocturnal in its habits, many Christmas Island robbers are active during the

MAS ISLAND

day and are, therefore, very obvious to the human inhabitants. Little wonder that they also appear on the island's stamps (5C, 1963; 30C, 1985).

The robber crab is not the only "false" terrestrial crab on Christmas Island, for there are also three more conventional hermits that, like their marine cousins but unlike the robber, still carry a mollusk shell house in which to protect their soft and delicate tails. Two of these, the Purple Hermit (55C, 1985) and the Tawny Hermit (45C, 1985), are featured on the island's stamps, while the much rarer Red Hermit is not so honored. All three species are widely distributed in the Indo-Pacific region where they are almost always found relatively close to the sea, either on the beach itself or on the immediately adjacent shore terrace, though the Purple Hermit is occasionally encountered further inland on Christmas Island. This attachment to the aquatic environment is common to all decapods, including the robber crab, for no matter how well-adapted to a land existence the adult stages may be, almost all of them pass through a shrimplike larval period that must be spent in the sea. Consequently, when the eggs are ready to hatch, the females must return to the sea to release their hundreds or thousands of tiny offspring.



But these seaward breeding migrations of the female hermit crabs and the robber crabs pale into total insignificance beside those of the island's true crabs, and particularly the red crab, *Gecarcoidea natalis*. Some of the island's true crabs, bearing such colorful names as the red nipper (60C), yellow nip-

per (90C), little nipper (85C), rock hopper (60C), blue crab (33C), mottled crab (45C), and ghost crabs (40C and 90C), occur in numbers not extraordinary for an oceanic island.



Such is not the case for *Gecarcoidea natalis*. The red crab's Latin specific name reflects the fact that it was first discovered on Christmas Island and may well be restricted to it, though there are very similar species on some of the nearby islands. But whether it is unique to Christmas Island or not, this is undoubtedly its true home. For the island's 135 square kilometers carry an estimated staggering 120 million red crabs with a total weight of more than 8,000 tons! Unlike the hermit crabs and other true crabs, the red crab is found all over the island, wherever it can forage on the forest floor in search of fallen leaves, fruits and flowers, or even the carcasses of animals, including its fellow crabs. Although like all land crabs the red crab must conserve moisture and consequently spends much of its time in its cool, moist burrow, its sheer abundance, and the fact that it is day-active, make it the most conspicuous animal of the forest regions throughout the year. But during its breeding migration, appropriately concentrated in the period leading up to Christmas, it leaves its forest home in such vast hordes that it dominates the whole island and provides a natural spectacle rarely equaled anywhere in the world.

Migration activity usually starts in November with the onset of the wet season. Up to three migrations take place each year, the middle one usually overshadowing the other two. This main migration

lasts between nine and eighteen days, the crabs moving almost entirely during the day and remaining stationary overnight. The great march is led by the largest males, up to four inches across the carapace, followed by the smaller males and then the females. The animals tend to congregate in enormous numbers at the edge of the forest before venturing across open spaces, and particularly the man-made ones such as roads and railways. Eventually, five to ten thousand crabs may cross such a barrier together as a slowly moving crimson carpet—a truly amazing sight, and one that involves considerable potential danger for the crabs, well over a million of them being killed each year by trains, cars, and trucks. But the number of crabs involved in the migration is so vast that this carnage makes little difference, and the island's human inhabitants have to learn to cope with the annual crab invasion. Driving can be hazardous, crab-caused punctures being by no means uncommon, while the golf course is probably unique in having special rules covering crabs moving or obstructing balls and blocking the entrances of the holes!



Eventually, the large males reach the shore and take up residence in burrows up to a meter long and thirty-five centimeters deep, which they dig in the terraces immediately behind the beach. During the rest of the year the crabs are generally rather peaceable creatures, but during the breeding season there is a great deal of fighting between the males for possession of the burrows and the surrounding square meter or so of territory. Most fights are fleeting affairs, over

Continued on page 12



ROGER CARWOOD/COLORIFIC



JOHN HICKS



JOHN HICKS

Residents of Christmas Island have reason to watch where they step during the red crabs' annual breeding migration.

in a few seconds and involving hardly any physical contact. But occasionally they can last many minutes and may even result in the death of one or the other of the combatants, though probably mainly from heat stress rather than from damage inflicted by the opponent.

Eventually, the males are joined and outnumbered by the females, each to be courted and mated with in a process that takes no more than about half an hour and results in sperm being deposited in two special receptacles opening on the female's underside. Mating usually takes place in the security of the burrow, but sometimes, and particularly in rainy weather, the crabs may mate on the surface where they risk being disturbed by their aggressive, and presumably jealous, neighbors.

Having now completed their part in the breeding cycle, the males leave the shore and return to their forest homes, leaving the females in possession of the moist burrows. Within three days of mating, each female produces a clutch of up to 100,000 eggs that are fertilized by the stored sperm and are attached as a spongy mass to the underside of the mother's tail. The embryos take only twelve to thirteen days to develop to the point when the female can release her enormous brood into the sea. When the time comes, the egg-laden females descend from the terraces to the water's edge in staggering numbers, sometimes piled on the rocks several-crabs deep at densities up to a hundred per square meter.

The actual release of the eggs takes place at night and just as the high tide is turning. In most cases the females walk into the shallows



where they stand upright with the claws raised, releasing the eggs with three or four vigorous shakes of the body and abdomen, after which the female retreats quickly from the water. Some red crab mothers, however, do not enter the water, at least not intentionally, but instead shake the eggs free into the sea from vertical rock faces up to eight meters above the water surface. This shaking behavior on such a precarious perch is fraught with danger, and hundreds of the females lose their footing and fall to their deaths in the sea below. The surviving eggless females now return to the forests in a reverse migration just as spectacular as the downward one, leaving their millions of offspring to the mercy of the ocean.

However they reach the sea, the eggs hatch immediately into tiny shrimplike, first-stage larvae called *zoeas* and look nothing like their parents. Little is known of their movements during the next few weeks, but about twenty-five days after their release, and having molted several times, they return to the Christmas Island shore, sometimes in sufficient numbers to make the tideline look like a band of brilliant red paint. Known as the *megalopa* stage, simply meaning "big-eyed," the animals are now intermediate in form between the free-swimming *zoea* and the adult crab. After two or three days spent milling around in the shallow water, they molt for the last time in the sea, emerging as tiny crabs, which then crawl out of the ocean and onto the dry land.

Considering the numbers of eggs produced by each female, the mortality among the larval stages during their short sojourn in the ocean must be extremely heavy. Indeed,

in some years none apparently survive to return to the shore. Every five years or so, on the other hand, the survival rate is so good that the spectacle of the landward migration of the baby crabs rivals those of the adults. On these occasions the migrating crabs form a seething pink carpet that takes about nine days to move from the shore to the plateau forest two hundred meters above and provides a succulent food bonanza for a variety of birds—and adult crabs—on the way. Three or four years later the survivors of this pink horde will join the annual seaward migration of the adults, to start the cycle all over again.

Not surprisingly, red crabs appear on five different Christmas Island stamps, from a 33C issue (1985) to a series of four stamps depicting various stages of the crab's life history (the 30C, 40C, 55C and 85C issues of 1989). And perhaps this is not excessive after all. Anyone visiting the island will certainly need a plethora of postage. As a natural phenomenon unrivaled in the animal kingdom, this is a sight that is definitely worth writing home about.

A.L. Rice is a deep-sea biologist at the U.K.'s Institute of Oceanographic Sciences Deacon Laboratory in Surrey, to the south of London. Prior to joining the Institute staff in 1973 he was, for seven years, the Curator of Crustacea at the British Museum (Natural History) in London. His philatelic interest concentrates on stamps depicting either crustaceans or aspects of the history of oceanography.

Joel W. Martin is Associate Curator of Invertebrate Zoology at the Natural History Museum. His research centers around the evolution and life histories of decapod crustaceans.



THE MAKING OF A NATURAL HISTORY POSTAGE STAMP

by WENDY SMITH-GRISWOLD

As a scientific illustrator, I am called upon to work within a broad spectrum of requests ranging from textbook drawings to full-color posters depicting rain forest biota. But the most novel and exciting assignments by far have been illustrating natural history subjects for postage stamps. Transforming ideas into "little bits of sticky paper" that are miniature works of art is, for me, an intensely creative and educational process, drawing on my skills as researcher, designer, and artist.

This process first began with a request from a New York-based company, the Intergovernmental Philatelic Corporation (IGPC), to create a set of eight stamps and two souvenir sheets depicting mushroom species of Antigua and

Barbuda, two Leeward Islands in the Lesser Antilles. The company provided the size specifications and denominations of the stamps. My research was based on a variety of references, and I consulted with Dr. Don Reynolds, Curator of Botany, at the Natural History Museum of Los Angeles County (LACM) who specializes in mycology, and the National Fungus Collection in Beltsville, Maryland. Ms. Florence Nishida, LACM Research Associate, whose special interest is tropical mushrooms, has also assisted me in research on other stamp projects. A list of local species may be provided by the country, or as in the case of the mushroom stamps, I chose species which then had to be approved by the country.

With the list of species in hand, I

proceeded to design each stamp, choosing a vertical or horizontal format and the typeface for the text. My job was to produce four-color camera ready artwork for the printer with the type pasted on a clear acetate overlay. The souvenir sheets were especially challenging to design, because I had to create a stamp which, when perforated, can be used separately, yet is integrated with the rest of the sheet to form an entire picture.

The original stamp artwork was painted at four times the final size of the stamp, and the souvenir sheets were painted at twice their final size. These illustrations were executed in the dry-brush watercolor technique on hot-press (plate finish) watercolor paper. This simply means that I used very little water on the brush to apply pig-



Cantharellus cinnabarinus
(red chanterelle)

ROUGH PSATHYRELLA

25¢

Psathyrella tuberculata



Psathyrella tuberculata
(rough *psathyrella*)

ANTIGUA ♦ BARBUDA

ment onto a dry surface as opposed to the wet-on-wet watercolor technique. I also used a touch of Berol Prismacolor pencil to define outlines and blend colors.

My preference is to work from real specimens, but with many of these subjects, I usually have to work from a variety of slides, published photos, and technical journals. Sometimes I get lucky and can refer to my collection of photographs taken in the field. The images on the stamps are composites of sketches made from trac-

ings of various figures that have been enlarged or reduced to the correct proportions.

I sent the first completed stamp to the IGPC for review and, on acceptance, continued with the remaining designs. The finished artwork was sent with written instructions to the printer, and the souvenir sheet stamp perforations were indicated on tissue overlays. All of the completed illustrations were then reviewed by the IGPC and a philatelic review board or commission in Antigua. Not all

stamp designs are used, although the artist is always paid for the completed work. In the case of the mushroom stamps for Antigua and Barbuda, all the designs were used.

After review, the illustrations were sent to a printer who prepared the artwork for printing by photographing the work and making color separations. The IGPC uses English, Irish, or continental European printers instead of domestic printers, because the start-up costs are less for the size of

Each year, the Museum Travel Program seeks unique destinations and unusual adventures for its members. In 1991, Your View to the World offers a variety of rich opportunities for new and seasoned travelers.

Tours are planned by museum staff in conjunction with the best professional educational tour operators. Our goal is to expand the educational opportunities provided by the Natural History Museum, and to provide our members with an increased global awareness. To highlight natural history, a museum curator or local expert accompanies each group, while an experienced tour manager handles travel logistics.

JOIN US!
OUR 1991 PROGRAM
PROMISES TO BE THE
BEST EVER!



EVERGLADES AND FLORIDA KEYS

January 25 - February 3, 1991
Explore coral reefs, barrier islands, mangrove swamps and sawgrass prairies in Everglades National Park and the Florida Keys. Photograph the herons, otters, alligators and manatees who make this subtropical paradise their home.

\$1,903 plus airfare of approximately \$350.



IN THE FOOTSTEPS OF SCOTT AND SHACKLETON

February 3 - March 2, 1991
Retrace the footsteps of early Antarctic Explorers aboard the luxury expedition ship "World Discoverer." Explore remote islands of the Southern Ocean. View the seals, whales, penguins and seabirds that congregate during the austral summer.

From \$12,910 plus airfare of \$1,400. Limited availability.

AMONG THE GREAT WHALES

February 8 - 19, 1991
Voyage to Baja California and the Sea of Cortez aboard the 74 passenger "Sea Bird." Visit Laguna San Ignacio and Bahia Magdalena, where California gray whales give birth to their young. Study the plants, birds, animals and geology of Baja's pristine desert.

From \$2,800 plus airfare of approximately \$259.

WINTER IN YELLOWSTONE

February 16 - 22, 1991
Discover the beauty of winter in the world's first National Park. Traveling by snow coach and sleigh, view the moose, bison, Canada geese, bald eagles and trumpeter swans attracted by the year round warmth provided by Yellowstone's geysers and fumeroles.

\$1,148 plus airfare.



COPPER CANYON, MEXICO

March 24 - April 3, 1991
Ride the world renowned "Ferrocarril al Pacifico" Railroad through Mexico's beautiful Copper Canyon. Observe the Tarahumara Indians in their celebrations of "Semana Santa", the holy Easter week.

\$1,350 plus airfare.

SPICE ISLANDS OF THE INDIAN OCEAN

May 17 - June 3, 1991
Sail to the remote islands of the Indian Ocean, fragrant with spices and rich in unusual flora and fauna, aboard the "World Discoverer." Visit Mauritius, Reunion, the Comoros and Seychelles Islands. Explore Mombasa and Zanzibar. Discover Madagascar's unique wildlife species. Optional post-cruise Kenya safari.

From \$5,450 plus airfare.

MICRONESIA

June 22 - July 6, 1991
Few are familiar with these 2,000 enchanting islands scattered over the north Pacific. Visit local artisans and explore the marine environments of Hawaii, Pohnpei, Truk Atoll, Guam, Yap and Belau on this cultural and natural history tour.

\$3,400 approximate cost plus airfare.

SOLAR ECLIPSE IN BAJA

July 9 - 14, 1991
On July 11, the sun will be in total eclipse for nearly seven minutes. Experience this once in a lifetime event, and also explore the fascinating botany, geology and marine life of Baja.

\$995 plus airfare.



NATURAL TREASURES OF ECUADOR

July 18 - August 3, 1991
Travel by foot and dugout canoe to the virgin tropical rainforest at La Selva. Shop in Quito and at the Saquisilí Indian Market. See Cotopaxi National Park and the world's highest active volcano. Cruise through the Galapagos Islands aboard the 20 passenger "Bartolome."

\$4,708 including airfare.

ANCIENT AND LIVING GREECE

September, 1991
Experience the splendor of ancient Athens. Travel through history to Corinth, Mycenae, Olympia and Delphi, enjoying museums, archaeological sites, Byzantine monasteries and quaint tavernas along the way. Cruise to Mykonos, Santorini, Rhodes and ancient Ephesus.

\$2,500 approximate cost including airfare.

TREASURES OF MOROCCO

October 5 - 19, 1991
Meet us at the Kasbah in Tangier. Visit royal palaces and museums along the road from Rabat to the minaret-studded city of Fez. Drive through the Atlas Mountains to Erfoud, gateway to the Sahara. Shop in the lively and colorful marketplace of Marrakesh. Conclude your stay in Casablanca.

\$2,580 plus airfare of \$1,026.



Please Note: Dates, schedules, program details and cost, based on information available August 1, 1990, are subject to change and revision.

Please send me information about:

- ☐ Everglades and Florida Keys
- ☐ Antarctica Expedition
- ☐ Baja and the Sea of Cortez
- ☐ Yellowstone in Winter
- ☐ Copper Canyon, Mexico
- ☐ Spice Islands of the Indian Ocean
- ☐ Micronesia
- ☐ Natural Treasures of Ecuador
- ☐ Solar Eclipse in Baja, California
- ☐ Greece
- ☐ Treasures of Morocco
- ☐ Guatemala: Heartland of the Ancient Maya

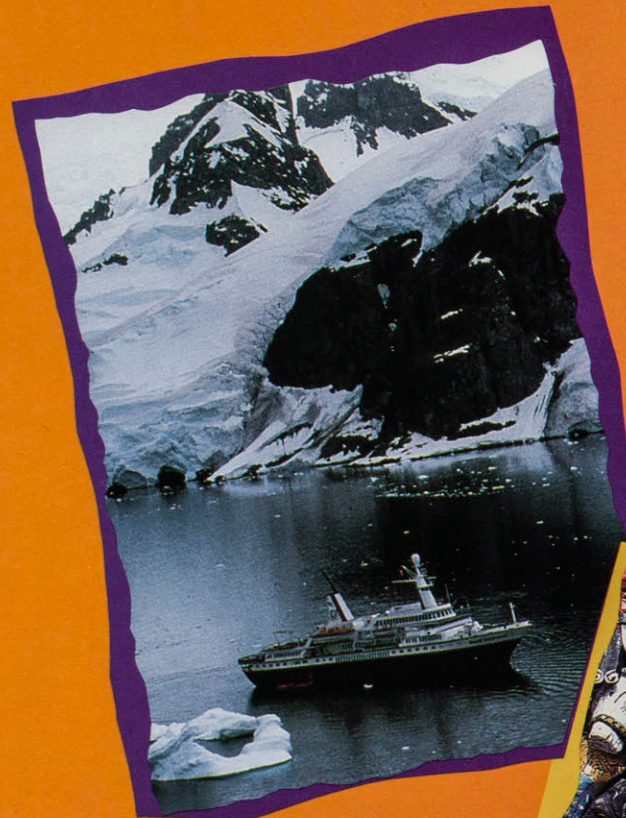


Name _____
Address _____
City/State/Zip Code _____
Daytime Telephone Number _____

Have you traveled with the Museum before? _____

Yes! I am interested in information about the Museum Travel Program

Please return this card to:
Karen Hovanitz
Museum Travel Program
Natural History Museum
900 Exposition Boulevard
Los Angeles, CA 90007



For further information,
please contact:

Karen Hovanitz
Museum Travel Program
Natural History Museum
900 Exposition Boulevard
Los Angeles, CA 90007
(213) 744-3350

YOUR VIEW TO THE WORLD

MUSEUM TRAVEL PROGRAM, 1991

Natural History Museum of Los Angeles County

the press run usually produced by this company. The House of Questa (London) printed these stamps by the process of multi-color offset lithography, which produces sharper colors and is considered the most modern and cost-effective color printing process available.

Color proofs of the stamps were sent from the printer to the IGPC and to Antigua for final approval. The proofs look just like the stamps but without the perforations. Once approved, the stamps were sent to the main post office in Saint John, the capital of Antigua and Barbuda. There, postal officials broke apart the sheets and sent the stamps to other post office branches in the country. Generally, one-half or more of the stamps issued go to collectors' sales. About two-thirds of the mushroom stamps went to the philatelic trade, while the remaining stamps were shipped from the printer directly to the post office in Saint John.

The percentage of stamps issued for postal service depends on the country. The high literacy rate in Antigua and Barbuda, combined with a significant emigration to the United States, has created a need for stamps to service a high correspondence rate. The stamps are expected to sell at the Antigua and Barbuda post offices for one to two years.

Back at the IGPC, the original artwork sits stored in a vault for safekeeping. Counterfeiting is not as great a concern as is controlling the use of the original artwork. Sometimes philatelists are interested in purchasing the original work from the artist, but because the country has paid to use the work for stamp production, other use of the art is prohibited.

I am currently working on a definitive stamp issue depicting local flora of the British Virgin Islands. Definitive stamps are designed primarily to serve the public's postal needs, so only about ten percent of these stamps are sold to collectors. There are

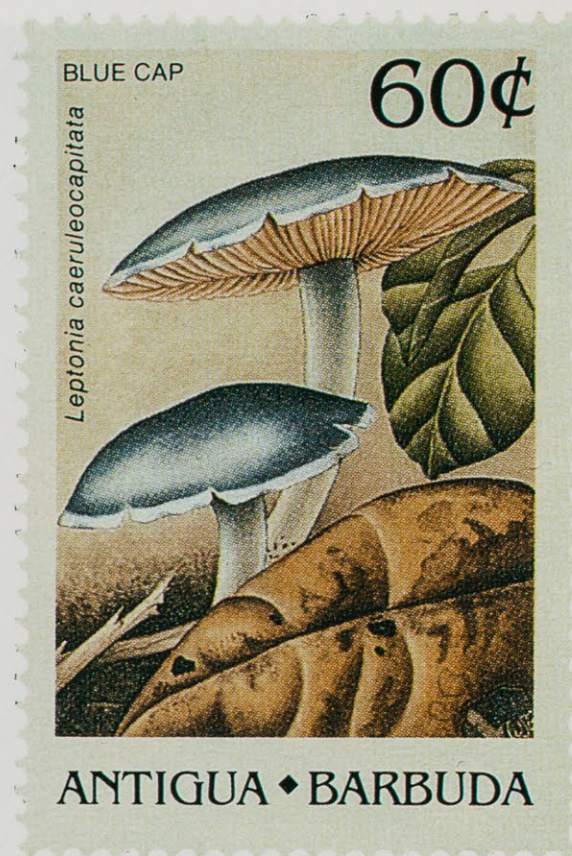
eighteen to twenty different stamps, each having a different value, in a definitive stamp set. The set sells for four to five years. The floral stamps will be issued with a brochure showing the stamp designs and listing technical details such as the name of the designer/illustrator, printer, the printing process, number of stamps per sheet, perforation gauge, release date, and so on. Again, I have used a variety of references to research the topic and have received extensive help from Mr. Robert Gustafson, Collections Manager for the Botany section of the museum, Mr. John Trager, Curator of Desert Collections at the Huntington Botanical Gardens, and from the library staff of the Los Angeles County Arboretum. These stamps, as all others, may take a few months to a year to be issued after the artwork is completed.

All of these stamps will be available indefinitely through philatelic catalogues. As Mr. Daniel Keren, spokesperson for the IGPC, put it, "stamps will always be sold, always be collected, and always be appreciated." As an environmentalist and scientific illustrator, I hope that public exposure to natural history subjects in any form increases an appreciation for other species on our planet and fosters at least a general awareness of conservation issues. My role in this capacity gives me the greatest satisfaction from my work.

Readers interested in learning more about stamps may write or call the American Philatelic Society, P.O. Box 8800, State College, PA 16803 (phone 814-237-3803).

Acknowledgments

I am grateful to Dr. Don Reynolds, Ms. Florence Nishida, Mr. Robert Gustafson, and Mr. John Trager for all of their assistance in helping me research the various topics illustrated on the postage stamps. I also thank Dr. Lawrence G. Barnes, Mr. Dean Griswold, and Dr. J. D. Stewart for their helpful comments on the manuscript.



Leptonia caeruleocapitata
(blue cap)



Leucopaxillus gracillimus
(slender stalk)

Wendy Smith-Griswold is Scientific Illustrator for the Museum's Earth Sciences Division, where her work includes drawing fossils and the creation of maps, charts, and diagrams for publication. Designing stamps and other similar projects are a spare-time activity providing an additional outlet for her creativity. She previously con-

tributed to *TERRA* with assistance and photographs for the article "The Tame Sting Rays of St. John Island" (*TERRA*, Spring 1990). Wendy has also contributed recently to *Terra* with illustrations for the article "How Big Was It? Determining the Size of Ancient Birds" (*TERRA*, Summer 1990).

SALVAGING THE PAST AT RIO AZUL, GUATEMALA

by RICHARD E. W. ADAMS

Books, maps, articles, pages of brightly colored illustrations, drawings, and tables make up the end product of most archaeological work. Occasionally, there is also an exhibit of the materials such as the one focused on the site of Río Azul appearing at the Natural History Museum from September 1 through November 11. Ultimately, when exhibits are gone and the artifacts are on shelves and in drawers, the most lasting and most important result of archaeology is information and the understanding of the ancient past that it affords. No collection of undocumented pretty pots can tell us as much about our common cultural heritage as the tedious and grimy work of the field archaeologist. Nothing illustrates this point better than the contrast between the discoveries of the archaeological project at Río Azul and the probable losses from the intensive looting carried out before our arrival. As a demonstration, a brief summary of our work at the site and of the major discoveries will be punctuated by comments on the effects of depredations of the antiquity hunters. Five seasons of field work by the joint U.S.-Guatemala Río Azul Archaeological Project have yielded a detailed picture of Maya culture at this one city, but we must also refer to the general context established by many other studies.

The Maya were a spectacular and early civilization that forms part of our common cultural heritage. They have gradually taken their place in our consciousness as an interesting and instructive example of people who underwent experiences common to most of humanity and solved or failed to solve problems that have confronted all cultures. Because they lived in a tropical forest environment, which also looms larger in our world view today, we are especially interested in their manner of dealing with problems of life in such an area.

The site of Río Azul is located in the northeastern corner of what is now Guatemala. The Department of Petén is largely an area of tropical lowlands; none of the Río Azul zone is more than 400 feet above sea level. Low limestone ridges covered with high forest alternate with river or swamp zones that support only low brushy jungle. The present-day appearance of unbridled nature is deceptive, however. One of the things that we have found at Río Azul and other sites is that by the time the Maya had reached a state of civilization and were building cities, they had

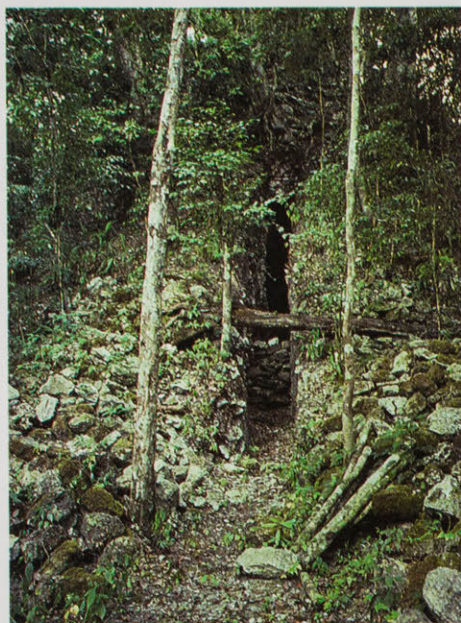
also tamed the forest and the natural landscape. Their ancestors had come into the lowlands as pioneer farmers at least by 2000 B.C. and by 1000 B.C. had occupied the ridge along the Río Azul where the later city would be built. By 500 B.C. most of the forest had been cleared, the human population had spread everywhere and established small farming villages, and a few places had begun to construct large pyramids and platforms as places of worship. The Río Azul zone became a location for several such platforms and pyramids by about 100 A.D. It seems probable that several families parlayed economic advantage into permanent superior social position. Ancestor worship was a major theme of Classic Maya religion, and later temples were places of burial for the distinguished dead. It was probably the development of this religious element that allowed certain families to become hereditary rulers.

About 360 A.D. the great city of Tikal, about 45 miles to the southwest of Río Azul, made an alliance with the central Mexican city of Teotihuacán. The linkage seems to have been military as well as economic because Tikal began to expand, and it conquered Río Azul in about 380 A.D. At Río Azul the conquest was memorialized by three round masonry altars covered with stucco bas-reliefs showing the execution of the former rulers of Río Azul. The altars were located on a plaster floor in front of a small platform with stairs leading to its top and, probably, to a small temple. The altars were found by Miguel Orrego, a Guatemalan archaeologist with the Río Azul Project, while he was exploring a looters' tunnel under a later structure. The looters had come within fourteen inches of hitting the altars.

In 392 A.D. a large carved stone monument, called Stela 1 by archaeologists, was erected in front of the enlarged temple that by then covered the conquest altars. Meanwhile, the massive and ancient temple of the former rulers was razed and its huge platform covered by earth and stone. A series of governors appointed from Tikal ruled the district from Río Azul for the next 150 years. Glyphs on Stela 1 mention an early governor whose name has been translated by Guatemalan epigrapher Federico Fahsen as "Zak Balam" (White Jaguar).

The years from about 390 to 540 A.D. were the great period of the city, and nearly all of the 739 buildings at Río Azul were constructed during this time. Our population estimates for the city





B. CONGER, RIO AZUL PROJECT

Trench cut by looters into the ancient temple covering Tomb 1, the former resting place of Governor X. More than 100 trenches and tunnels were dug by vandals at Río Azul.

Río Azul Stela 1 with a date equivalent to 392 A.D. memorializes a governor, White Jaguar, who had conquered a neighboring ruler. Many such monuments have been broken into pieces for sale in the world art markets.

are based on the amount of covered space in the city and capacities of buildings. For the Early Classic period (ca. 300–550 A.D.) the maximum population was 7,500 people, of whom many were elite class members. Surprisingly, the countryside seems to have been thinly populated. Yet Río Azul has reservoirs, acres of paved plazas, probable defensive structures, and gigantic buildings. Structure A-3 complex, a set of five connected temples, still rises to about 155 feet above the jungle floor and originally measured about 180 feet high. Its bulk measures about 320,000 cubic feet, and this is only the largest of many impressive structures.

Construction crews were probably imported to build most of the city. Tikal, as the capital of the regional state to which Río Azul belonged, must have had a strong reason to want a large city in that zone. Based on other studies, it now appears

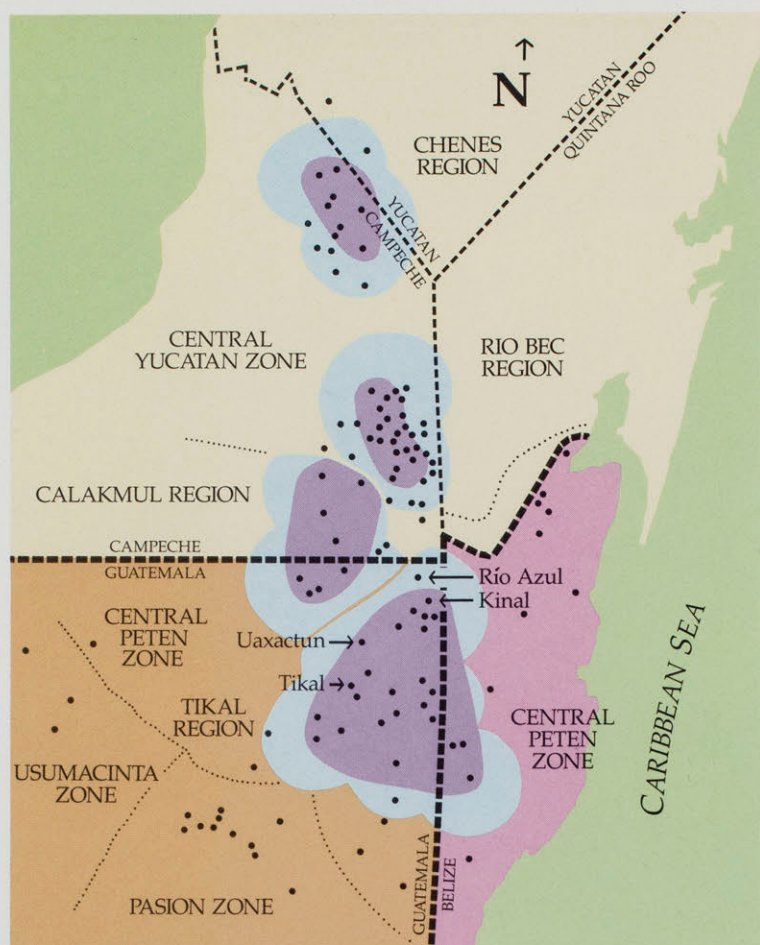


RICHARD E. W. ADAMS

that Río Azul was on the northwest boundary of the Tikal regional state, and as such was a frontier fortress. The river from which the site takes its name also provides a connection with the Caribbean for canoe traffic. Many seashells found at Río Azul come from that sea, and many others are from the lower part of the Gulf of Mexico off the Veracruz coast. From this evidence we conclude that Río Azul probably was also a trading city.

Palaces within the city provided spacious and comfortable living quarters for noble families. Servants' quarters have been found in the palaces along with other amenities such as kitchens. Food grinding stones were imported from the Maya Mountains to the east in what is now Belize, and a number of chert tools were produced locally for daily tasks and construction work. Handsome polychrome pottery was used in the palaces for

View of the south side of roofcomb on top of a Río Azul temple showing modeled stucco hieroglyphs that date to the fifth century A.D. The upper right glyph is the ancient Maya name for Río Azul.



Map of the Maya Lowlands showing four of the probable twelve Classic-period Maya regional states. Río Azul belonged to the Tikal regional state.

dining and for humbler usages. The decorative motifs seem to have functioned somewhat like the family crests of European nobility on their formal china.

Most of the tombs of Río Azul date from the Early Classic period and many of them are painted with murals. The most spectacular example is Tomb 1, looted some time between 1976 and 1981. Thankfully, however, the murals were largely undamaged, and they give us invaluable information about the ruler, known as "Governor X" to archaeologists, originally buried here. He appears to have been the son of a ruler of Tikal, one "Stormy Sky," and was born in 417 A.D., according to the mural and its hieroglyphic text. His father's and mother's coats of arms are to the left of text and those of his grandfather ("Curl-Nose"), another Tikal ruler, are to the right. The visage of the sun god rises above the grandfather's emblem and constitutes a claim to divine kingship.

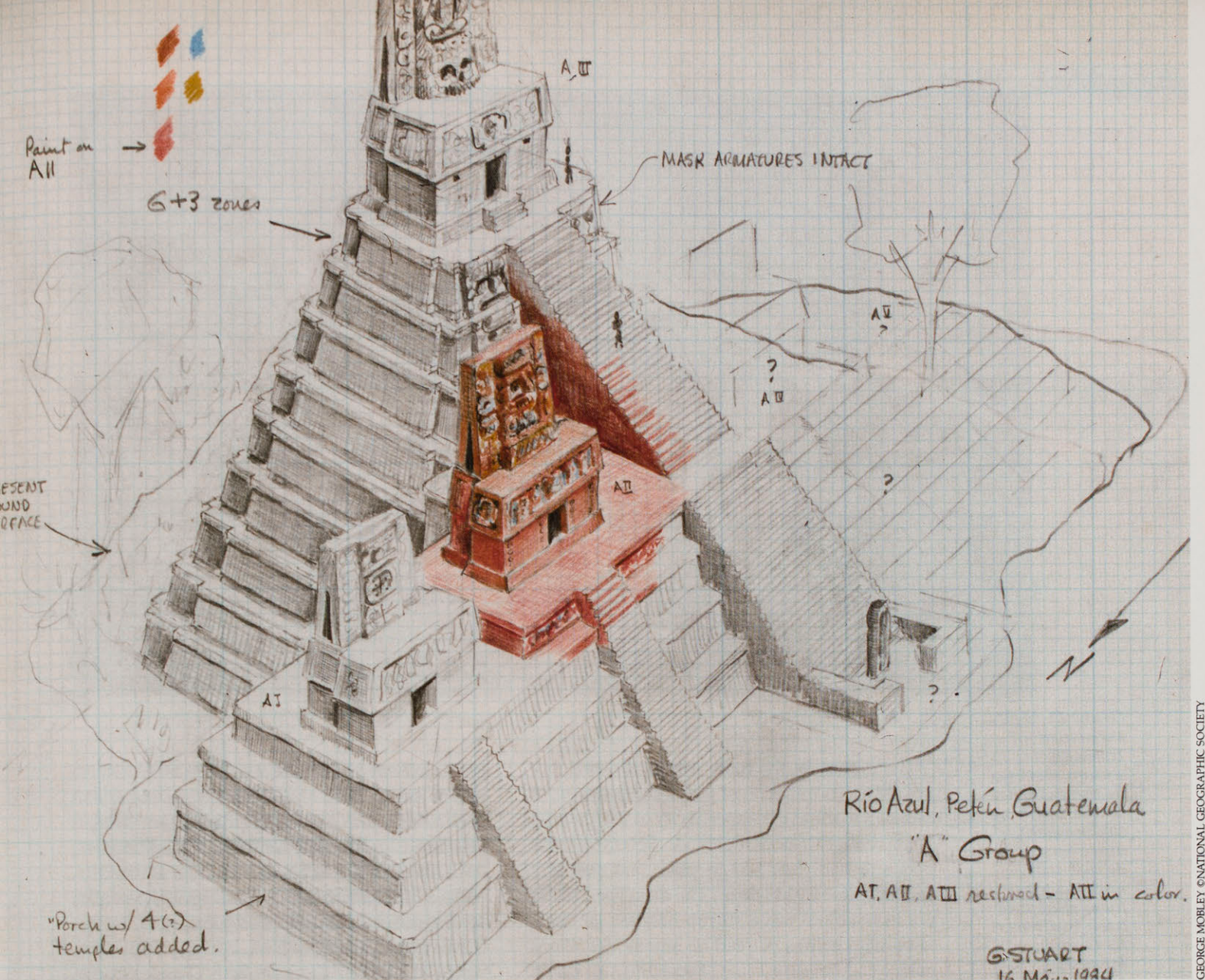
The loss of data caused by the looting of Tomb 1 is irretrievable. The pottery, jade, seashells, and bones that were probably in it are lost forever, and so is about 90 percent of the information about Governor X. We think that Governor X died about 460 A.D., based on stratigraphy, pottery, and radiocarbon dates. A number of looted tombs with murals seem to have been those of relatives. The murals display the storm god as a

principal motif and evidence indicates that he was probably a patron deity for this elite kinship group.

Our salvage work in these looted tombs centered on the recording of the wall paintings and their priceless information. Fortunately, the looters found that they could not remove the paintings and only severely damaged two of them. In Tomb 12, we found a text that ultimately allowed us to identify a pottery vessel now in the Detroit Institute of Fine Arts. The tomb's text as deciphered by David Stuart reads: "On 20 March 450 A.D. was buried Six Sky _____ of Río Azul." Six Sky's name and the emblem glyph of Río Azul are both on the Detroit Institute vessel, indicating that it was looted from this tomb.

While such information is valuable in itself, it is necessarily incomplete and gleaned from the leavings of the tomb robbers. We were eager to find several untouched tombs of the same date as those that had been looted to check some of our tentative ideas as well as for the remarkably preserved items that evidently were in the burials. Ian Graham, the archaeologist who put an end to the looting of the site, had found a fragment of a remarkable carved wooden bowl in the vandals' camp. The piece had evidently come from a tomb, but of course the precise one was unknown.

In 1984 we found our first unlooted tomb; we found several others in the years that followed. Tomb 19, the first legitimately discovered tomb, was physically associated with Tomb 1 and seems to have been the burial place of an advisor to Governor X. As was the case with nearly all the fifth century elite burials, the tomb was placed under the bedrock in an artificial cave. The forty-year-old male interred in the tomb was wrapped in a shroud made of several pieces of cloth. Analysis by Robert Carlsen of the University of Colorado showed that at least one piece of cloth was an open-weave cotton fabric with embroidered designs. It is very similar to textiles still produced on handlooms today by Kekchi Maya Indians from around the modern city of Cobán, Guatemala.



GEORGE MOBLEY © NATIONAL GEOGRAPHIC SOCIETY



GEORGE MOBLEY © NATIONAL GEOGRAPHIC SOCIETY

National Geographic Archaeologist George Stuart sketched this reconstruction of a Río Azul temple complex based on parts of the temples that still stand today. The central portion shows colors of paint that still remain on the stuccoed temple. The temple complex, which now rises about 155 feet above the jungle floor and which was originally 180 feet high, is the largest of the many impressive structures at Río Azul. These include paved plazas, defensive structures, and massive buildings.

Temple A-3 (lower right) can barely be seen peeking through the dense jungle that has overgrown the ruins of Río Azul. When the Maya lived in this area, much of the forest had been cleared, and small farming villages dotted the landscape. A possible reconstruction of this temple complex can be seen above.



B. CONGER, PROPERTY RIO AZUL PROJECT

Grant D. Hall, excavator of Tomb 19, is shown sitting in the entrance to the tomb at the moment of discovery. The burial was under a platform that had been built next to Governor X's memorial temple.

The pottery in the tomb was remarkable, but mainly for its imitation of forms characteristic of ceramics made at the imperial city of Teotihuacán in the central Mexican highlands. Several of these pots still had their lids in place and powdery residues were inside them. The most spectacular pot in the tomb was a stirrup-handled jar decorated with glyphs painted on stucco medallions colored a delicate blue. According to David Stuart, the text on the pot indicates that the owner was the "servant of the heir to power [prince]." The text on the lid made the startling statement that the pot was meant to hold chocolate (cacao). The powdery residue from this vessel was analyzed by Hershey Food Corporation scientists and it was confirmed that it and the other vessels had held chocolate in the form of a drink.

Analysis of the bones in the tomb show evidence of trauma during the man's lifetime, probably as a result of blows. These and other data hint that he was probably a soldier. A matching tomb, Tomb 23, on the other side of Governor X's resting place held the remains of another male, an advisor who was also probably from Teotihuacán, judging by the pottery in his tomb.

Combining this information with that from Río Azul's capital city, Tikal, we begin to see a picture of expansion of a large Maya regional state with the help of advice from a powerful commercial and military power located in central Mexico. We know from studies at Tikal that Governor X's father was also advised by Teotihuacán warriors, as his grandfather, Curl-Nose, probably was. The

latter appears to have usurped the Tikal throne and allied himself to Teotihuacán. The earlier, displaced ruling families seem to have tried a comeback in the sixth century A.D. This may have resulted in a series of civil wars among the Maya elite families. Río Azul was apparently burned out and otherwise badly damaged during these disturbances, which lasted about sixty years. At Río Azul there are Early Classic palaces that show fire marks on their walls. Abandonment of the city led to dilapidation of the large structures and collapse of walls and roofs.

By about 700 A.D. Río Azul was reoccupied and a program of refurbishment of major buildings was initiated. By and large, however, no new major structures were constructed. Late Classic Stela 2 at Río Azul dates from about 774 A.D. and, according to the studies of Stephen Houston, names a new set of ruling families at the city. The older families with the storm god as a patron had disappeared, perhaps in the turmoil of the civil disturbances 150 years before. In fact, it now appears that Río Azul had become a distinctly third-rate site, occupied mainly for its military importance. A new administrative city, Kinal, was built about twelve miles distant on a more defensible ridge.

Meanwhile, out in the countryside during the Late Classic period, there is evidence of prosperous farmsteads whose inhabitants were cultivating the wetlands. Small swamps were drained and raised fields were created, possibly for specialty crops such as cacao. We found huge dumps



RICHARD E. W. ADAMS

Looted Tomb 2 showing the remaining murals on its walls. The storm god is depicted on the end wall.

of chert debris left over from the manufacture of thousands of standardized stone tools. These implements were used to dig drainage canals through the swamps and to cultivate the fields. All over the Maya lowlands at this time we find evidence of large-scale swamp gardening, probably driven by population growth. Water drainage and its side-effects were later to be involved in the collapse of Maya civilization in the southern lowlands.

Río Azul has also given us new insights into the nature of the Classic Maya collapse, which occurred within a period of about seventy-five years beginning 830 A.D. In the case of Río Azul, it appears that the city was again destroyed by military action. This time, the evidence points to other Maya cities and states to the north, probably cities such as Uxmal in the Puuc zone of northern Yucatán. A crude stela was found at Río Azul that reflects the style of late northern Maya sculpture; it even contains elements similar to those found in stone carvings in Toltec Chichén Itza.

Several students of the Maya collapse have suggested that changing weather patterns may have triggered predatory raids from the agriculturally more vulnerable northern Maya cities. They may well have been raiding not just for the loot, but also to capture manpower. It is about this time that the Puuc cities show a dramatic rise in population. Some of the southern cities, such as Río Azul—already suffering from problems of overpopulation, food production, management difficulties, and other factors—were tipped over

Río Azul

City of the Storm God

Through November 11, Director's Gallery, Upper Level

The ancient Maya city of Río Azul in present-day Guatemala was a frontier outpost associated with the great city Tikal. Although Río Azul was heavily looted before scientific excavation could begin, archaeologists have found untouched tombs of highly placed dignitaries that shed new light on the Classic Maya world. A reconstruction of one excavated tomb is presented in the exhibition, as well as a combination of archaeological objects and photographs that bring the fifth-century A.D. Maya to life. Included in the exhibition is the well-known "chocolate pot," an unusual vessel that contained the powdery residue of a chocolate drink.

Río Azul: City of the Storm God was organized by the University of Texas at San Antonio in cooperation with the Ministry of Culture in Guatemala, the National Geographic Society, and the Denver Museum of Natural History.

La Opinión is the official media sponsor of the Río Azul exhibition.

the edge of disaster by the military raids. These intrusions in turn may have led to further problems because of the disruption of the agricultural zones, trading relationships, and other sensitive cultural systems built up by the Maya over a period of six hundred years. Widespread epidemics and plagues may have finished off the supporting populations and led to the collapse of the magnificent superstructure known as Maya civilization.

The sketchy picture given above of what we have learned from Río Azul and how it fits into the general picture of Maya civilization is indicative of what can be gained from field archaeology. We have analyzed thousands of pieces of pottery and chert tools at Río Azul and have mapped and reconstructed the plans of hundreds of buildings. Painstaking recording of data has led to the dating and specification of function of various parts of the city.

Private collecting of archaeological artifacts once could be justified by the argument that the collectors were preserving the past. This was before the advent of large public museums such as the Natural History Museum of Los Angeles

County or the Denver Museum of Natural History. Publicly held collections in such institutions are available for education and study. Private collections in the present day are investments and/or largely for the satisfaction of desire for social prestige or of an uncontrolled acquisitive instinct. Dealers obviously have a vested interest in justifying illegal excavation and the traffic in antiquities stolen from other countries. All these motivations are understandable, but, given the disastrous effects on our knowledge of the past, they are also reprehensible. If the chocolate pot with its "child-proof" lid had appeared on the market, we would have doubted its authenticity because of its unique nature. Further, we would not have been able to connect it with Governor X, and it is quite likely that any self-respecting dealer would have tipped out the nasty looking brown powder contained in it. It would have been just another pretty vase.

Richard E.W. Adams is Director of the Río Azul Archaeological Project and Professor of Anthropology at the University of Texas at San Antonio. His thirty-two years of field work in the Maya lowlands have taken him to excavations in Tikal, Altar de Sacrificios, Becan, and Kinal as well as to Río Azul.



Drawings by Miguel Orrego of the modeled stucco figures depicting the execution of Río Azul's formerly independent rulers. Each person is named by the hieroglyph on his back.





Reconstructed piece of Late Classic pottery salvaged from a looters' dump. Such pieces, while scientifically valuable, have no sale value and are therefore discarded by antiquity hunters.

Stone tools found in the raised fields of a suburb of Río Azul were used to build and cultivate raised fields in swamps around the city. Thousands of such tools were made to standardized specifications.



RICHARD E. W. ADAMS

The lid to this unusual vessel, called the "chocolate pot" for the cacao residue found within, twists off much like a child-proof cap on a modern medicine vial. The delicately colored pot was excavated from Tomb 19, in which an advisor to the ruler of Río Azul was buried. The glyphs on the jar's lid state that pot was meant to hold chocolate, which chemists from the Hershey Food Corporation confirmed.



NANCY JENKINS-REYNOLDS, DENVER MUSEUM OF NATURAL HISTORY

SUGGESTED READING

- Adams, Richard E.W., "Archaeological Research at the Lowland Maya City of Río Azul," *Latin American Antiquity*, 1, (January 1990).
- . "Río Azul, Lost City of the Maya," *National Geographic Magazine*, 169, no. 4 (April 1986).
- . editor, *The Origins of Maya Civilization*. Albuquerque: University of New Mexico Press, 1977.
- Carlsen, Robert, "Analysis of the Early Classic Period Textile Remains—Tomb 19, Río Azul, Guatemala," in *Río Azul Reports*, No. 2, *The 1984 Season*, edited by R.E.W. Adams. San Antonio: University of Texas.
- Culbert, T. Patrick, editor, *The Classic Maya Collapse*. Albuquerque: University of New Mexico Press, 1973.
- Hall, Grant D., Stanley M. Tarka, Jr., W. Jeffrey Hurst, David Stuart, and Richard E. W. Adams, "Cacao Residues in Ancient Maya Vessels from Río Azul, Guatemala," *American Antiquity*, 55, (January 1990).
- Hammond, Norman, *Ancient Maya Civilization*. New Brunswick, NJ: Rutgers University Press, 1982.
- Stuart, David, "The Paintings of Tomb 12, Río Azul," in *Río Azul Reports*, No. 3: *The 1985 Season*, edited by R.E.W. Adams. San Antonio: University of Texas.

THE LARGEST HOTEL AND WATERING PLACE IN THE WORLD

Tale of Baja California Hotel Mirrors 19th-Century Real Estate Booms and Busts

by DONALD CHAPUT

The American West has seen considerable exaggeration, promotional enthusiasm, and public relations hyperbole, but a hotel plan in Baja California in the 1880s must rank high on any list of unfulfilled superlatives. The place was Ensenada, and the man who aimed so high was Major Gabriel Erb of Salt Lake City.

Erb was a Pennsylvania youth who at eighteen joined the Union Army as a private in 1861, and by bravery, luck, and the vagaries of war ended his service as a major. Unfortunately, he was also a captive in the notorious Andersonville Confederate prison camp in Georgia. Following his release, he moved west to Illinois and operated a small hotel in Quincy for a few years, then in 1870 was invited to Utah by an officer in the Union Pacific Railroad to run a few eating houses, one in Wasatch, the other in Ogden.

In 1876 Erb moved into Salt Lake City, where he leased the Walker House. A few years later he added the local Townsend Hotel to his holdings, changing its name to the Continental House. By the mid-1880s, therefore, Erb was one of the best-known hotel men in Utah. He was on the board of the Rocky Mountain Electric Light Company, and was president of Salt Lake Power, Light, and Heating Company.

A Walker House visitor in 1886, a Dr. Snyder, extolled to Erb the beauties and commercial possibilities of the new colony just started in Mexico in Lower California. This huge chunk of land, pretty much the entire state of modern Baja California, was being colonized by the International Company, an American firm based in New York and Connecticut that had its headquarters at the port city of Ensenada. (See *TERRA*, September/October 1986, for an article on the Ensenada "boom.")

The following spring Erb went to Ensenada, talked to Mexican officials and International Company officers, looked over the beaches and countryside, and threw in his lot—and fortune—with the new colony. Erb was given all sorts of inducements, promises, and praise by the company. They gave him some acreage and sold him more at reduced prices. The lot was a spectacular site on Punta Banda, a peninsula ten miles across Todos Santos Bay from Ensenada and seventeen miles by road from that city.

Agreements were reached to build a wagon road, wharves, and piers. There were hot springs near the hotel's site, which would add to its value as a tourist attraction, and also only a mile or so away was the famous water blowhole, known to this day as *La Bufadora*.

One of the earliest Erb interviews appeared in the *Los Angeles Tribune* of June 4, 1887, and provides some information and a measure of the enthusiasm Erb had for the new hotel project:

The hotel will be 852 feet long, 80 wide and three stories high, and, while on the edge of the inner estuary or bay, will command a view of the Todos Santos Bay. This section is protected from the southwestern winds by mountains 3,000 feet high.

Between Punta Banda and Ensenada are four streams of fresh water that supply all that is needed for irrigation or domestic use.... The inner bay is full of a great variety of fish. I never saw so many before in my life. There are lots of turtles here, too. Some of them will weigh 300 or 400 pounds. The land will raise anything. A man named Bennett has several hundred acres of corn, and he has wheat which will average seventy bushels to the



SPECIAL COLLECTIONS DEPARTMENT, UNIVERSITY OF UTAH LIBRARIES

Is this the Ensenada hotel mogul? Identified as George S. Erb of Salt Lake City, this is possibly Gabriel S. Erb, the Salt Lake City hotel magnate.



acre. Oranges, lemons, and about everything you can think of, grow there.

To puff up the tourism-health angle, Erb hired a prominent Chicago chemist-assayist, Professor C. Gilbert Wheeler, to test the waters of the Punta Banda hot springs. Then, in newspaper ads and in a special leaflet, the glories of the hot springs were praised to the world. There was "no alumina present"; the waters were loaded with various sodiums and calciums. Wheeler claimed the springs were of "exceeding richness" and "one of the strongest waters I have ever analyzed."

The Erb enthusiasm for the Punta Banda hotel project was not based on the long tradition of European spas, such as the baths of Baden Baden, nor on such nineteenth-century U.S. health resorts as Hot Springs, Arkansas. Erb, the International Company, and many investors of San Diego, Los Angeles, and San Francisco believed that "the Eden of Earth" was aborning in and around Ensenada, thanks to a coming together of many financial, political, geographical, and transportation developments. The ideal climate, healthy hot springs, fish in the bay, land under cultivation, plans for a railroad, a rapidly grow-

ing population, and a good harbor meant that the Erb Hotel would be the center of a new urban hub. Erb used the word "mecca" and claimed the hotel would be a tourist magnet:

With its natural advantages, enhanced by convenient buildings, it will actually be the best.

The *Ensenada Lower Californian* of August 9, 1887, claimed that the hotel would be "the largest on the Pacific coast, or in fact the world." The same paper on August 18 stated that on completion, it would be "the largest and finest hotel on the continent. This is a big assertion, but it is true, nevertheless."

Local resources were inadequate to build such a magnificent structure, so Erb turned elsewhere. McDougall & Sons of San Francisco drew up the plans for the hotel. Erb personally went to Portland, Oregon, in the summer of 1887 to inspect and purchase lumber for the building. He claimed that the hotel would have 400 rooms and would take about one million feet of lumber to construct. "It is the intention to erect a first-class watering-place hotel, provided with all necessary conveniences for the comfort of guests."

These impressive figures were to

grow as the weeks went by. Soon, the number of rooms planned was given as 650, and the entire structure was to cost \$600,000. By late summer Erb had positioned himself well locally by hiring as his manager Colonel William S. Oliver of Missouri, a Civil War Union veteran who had been in several campaigns alongside General Grant.

There was some construction progress in the next few months, but not enough to justify the continual praise. The *Ensenada La Voz de la Frontera* of October 1 mentioned that 100 men were at work, the building for the hotel offices had been completed, and Colonel Oliver had improvised a bathhouse at the hot springs. In late October the huge Iturbide Hotel in Ensenada was opened with celebrations, dances, and dinners, and Erb and Oliver were guests at some of the functions. Such hotel success must have fanned their hopes for the Punta Banda project.

An account in the *Pasadena Union* of December 10, 1887, added a few more construction details. A "small but neat two-story hotel now affords accommodations to visitors." Erb told the *Union* editor that he planned to put in an iron pier 1,800 feet long and that the iron was already en route. "He also said he would do nothing more than grade for the hotel before the pier was put in, as it was too expensive to unload lumber or anything else without it."

On March 29, 1888, the *Lower Californian* published a summary of local activities and included news from Punta Banda, commenting on the hot springs and the surf bath. "Here is to be built a model hotel with over 600 rooms, and nearly every room a corner room." The newspaper was still using the future tense. What had happened to the iron pier? To the lumber from Oregon?

The year 1888 provided a series of crushing blows to Erb as well as to the entire Baja California development plan. The International Company, which had projects in New Mexico and Chihuahua as well as



PUNTA BANDA CITY

At the southern end of the beautiful crescent-shaped Bay of Todos Santos, Lower California, 60 miles south of San Diego, sends Greeting to the civilized world.

Situated on the high mesa ground south of the bay, it commands a view of surpassing beauty.

Among the attractions of PUNTA BANDA CITY are the following natural features:

Land-locked Harbor,
Perpetual Springtime Climate,
The Hunter's Paradise,
Five Natural Hot Springs,
Abundant Flowers,
Beautiful Views,
Natatorial Pleasures,
Art-inspiring Scenery,
Delightful Repose,
A Perfect Home,
Ten Mile Beach Drive,
Mountain Parks and Caves,
Natural Water Spouts,
Hot and Surf Bath at same time,
Hot and Still Bath at same time,
Hot Vapor Baths,
Hot Mud Bath,
Still Water Bathing,
Finest Surf Bath on Pacific Coast.

A Telegraph and Telephone line will be completed in ten days. The motor railroad will be completed within ninety days from Ensenada to Punta Banda City. Here are located the

:HOT: SPRINGS:

Baja California, collapsed. Scandals, poor management, and over-extension had led to failure. The pieces were picked up by a London firm, and the new name was the Mexican Land and Colonization Company, headed by a British Royal Engineer officer, Captain Buchanan Scott. Scott arrived in Ensenada, tightened all the loose organizational systems, put in economy measures, and aimed for corporate survival. Meanwhile, such schemes as Erb's colossal hotel, or the "world famous" Sisson University in Ensenada, were put on hold.

Another unfortunate event of 1888 was the inspection trip and subsequent publications by M. Sanchez Facio, an opposition politician from Mexico City who viewed the entire International Company venture as an anti-Mexican maneuver to populate Baja California with Yankees in preparation for annexation to the United States. The British company takeover did nothing to placate certain Mexican factions, which viewed all this foreign investment with alarm.

The most disastrous series of events that spelled doom for Gabriel Erb was the collapse of the land, railroad, and settlement fever that had led to such enthusiasm for the American West from investors. California, peddled as the "Mediterranean of North America," would suffer severely from this collapse. And the adjacent peninsula, Baja California, would not escape the fallout.

Gabriel Erb would never build his world-famous hotel. The failure of the International Company, the bitter political attacks of Sanchez Facio against foreigners, and the end of the economic boom in the western United States meant the end of any hopes Erb had for being a successful businessman in Mexico.

The period from 1889 to 1900 in Baja California was one of survival, not development. A gold rush at El Alamo in the Santa Clara District, 60 miles inland from Ensenada,

This ad from the Ensenada Lower Californian appeared for about a year extolling the salubrious attributes of the Erb Hotel's location.



SEAFER CENTER FOR WESTERN HISTORY RESEARCH

"HOTEL ERB" PUNTA BANDA, BAJA CALIFORNIA.

An inset view of the Erb Hotel illustrating an 1887 Ensenada boosterism map.

saved that community from ruin in 1889-90. But Ensenada's population dwindled, then leveled off; many buildings were left unfinished, and most foreigners left the peninsula. Punta Banda did get telephone and telegraph connections, and a decent wagon road was put in from Maneadero to the hot springs. Occasional visitors bathed in the hot waters or imbibed the local calcium drinks in the interest of better health.

The Ensenada *El Progresista* of May 3, 1903, summarized the recent failure of Erb to develop the land and mentioned a projected summer hotel and steamship line. Since then, plans by the dozen have been made for hotel and tourism

complexes, but Punta Banda is still relatively undeveloped.

Gabriel Erb was crushed financially by the Baja California hotel disaster. He drifted to minor hotel jobs in Omaha and Saint Louis until 1894, then finally returned to Salt Lake City, where he died in early December 1895. Funeral services were held on December 10 in the Walker House, the Salt Lake City hotel that had formerly been his showcase. His Ensenada venture was summarized in the *Deseret Evening News* of December 9:

He made considerable money but lost it in unfortunate Pacific coast investments and finally closed out his hotel business here.

Donald Chaput is a curator in the History Division. He and his colleague William Mason have created a massive computer documentation file on the history of Baja California, consisting of thousands of pieces of information drawn from maps, books, manuscripts, magazines, and newspapers. They welcome enquiries from professional historians, from those who travel frequently to Baja California, or from those who are curious to know more about the past of our neighboring California.

insight they provide into prevailing social customs, literature, patent medicines, foods, and general gadgetry.

We are indeed pleased to now have such a fine representation of this material available to our users.

STAFF NEWS

THE NATURAL HISTORY MUSEUM WELCOMES NEW DIRECTOR OF DEVELOPMENT AND DIRECTOR OF ADMINISTRATION, PAGE MUSEUM. Susan E. McCarthy has been appointed Director of Development for the Natural History Museum. Ms. McCarthy, who joined the museum in 1986, will be responsible for managing the museum's funding raising, membership, and special events programs.

Kathryn Sibley has been appointed Director of Administration at the George C. Page Museum of La Brea Discoveries. Ms. Sibley first worked with the museum from 1985 to 1989, leaving it to become Executive Coordinator of the Western Museums Conference. She will be responsible for day-to-day operations of the Hancock Park-based museum.

MUSEUM NEWS

NATURAL HISTORY MUSEUM AND NATIONAL SCIENCE FOUNDATION REACH ACCORD. The Natural History Museum of Los Angeles County Foundation and the National Science Founda-

tion (NSF) have signed an agreement that settles all questions raised by an NSF audit, under which the NSF will continue to fund meritorious proposals from the museum. NSF support has been very beneficial to the museum and to the public, augmenting county support and funding many important programs.

In the past decade the museum has experienced substantial growth in the amount and number of grants and contract awards it receives from a variety of sources. In 1981 the museum had three contracts totaling \$182,336, compared to more than twenty-three awards, totaling \$3.1 million, that the museum administers today. Special exhibitions such as **Sharks! Fact and Fantasy** and the soon-to-open Ralph W. Schreiber Hall of Birds are made possible by NSF funding, which also provides support for many of our research projects and collections.

In the agreement the NSF accepts the museum's accounting system for cost-reimbursement grants, including the time-keeping system and internal controls. It represents final and complete settlement of all cost issues for fiscal years 1983 through December 31, 1989. The museum has modified its accounting system to meet specific requirements relating to federal grants.

THE MUSEUM'S NEW CAFE B.C. The Natural History Museum is pleased to announce that it has retained the Morrison Management Company and its subsidiary Manask Food Services, Inc. to operate the museum's newly named Cafe B.C. The companies have many prestigious food service contracts, including Universal Studios and the Getty Museum. The Cafe B.C. features a menu that changes daily and includes hot entrées, a salad bar, soups, sandwiches made to order, fresh fruits, and a variety of beverages. Cafe B.C. will also provide catering and take-out services for the convenience of both staff and patrons. Hours are from 7:30 a.m. to 5 p.m. every day. The new cafe is located on the Natu-

ral History Museum's lower level; we hope our members will come and greet Mr. Jerry Salthouse, our resident manager, and try out the museum's new food service.

DEVELOPMENT NEWS

DINOSAURS! SPURS BEHEMOTH GROWTH IN MUSEUM MEMBERSHIP. The offer of free tickets to the recent **Dinosaurs!** exhibition helped volunteers sell a record number of memberships at the museum's membership desk. More than 1,389 visitors joined at the desk, located at the south entrance; a direct mail campaign that featured the exhibition brought in 1,328 new members.

We would like to thank our new members for their patience while they waited for the benefits as membership processing was delayed because of the large response.

THE MUSEUM WELCOMES NEW FELLOWS. More than sixty new Fellows have joined the program between July 1, 1989, and June 30, 1990. Spring activities included dinner at the Hale Observatory with Fellows Christine and Bill Shirley and a visit with collectors Ernie and Rebecca Lever. Short trips to Edwards Air Force Base, the Grand Canyon, and Cape Canaveral, and an Adventure in Discovery in Great Britain capped the program year.

Luncheons to introduce prospective Fellows to the program are held once a month from September through June. These luncheons are made possible in part by a generous gift from American Express Private Banking Service.

The museum welcomes the following new Fellows: Mr. and Mrs. Joel F. Citron, Mr. and Mrs. Timothy M. Doheny, Richard and Anita Dunsay, Mr.

and Mrs. Justin M. Fishbein, Mr. and Mrs. Gary J. Griff, Mrs. Harley J. Gunderson, Ralph J. Herman, Henry H. Hilton, Mr. and Mrs. Clifford Huntley, John Burke Kelley and Mrs. Janis M. Kelley, Richard Kelton, James and Amanda McIntyre, Don and Diane McLaughlin, James A. Mosso, Dr. and Mrs. Theodore B. Okie, Mr. and Mrs. Robert A. Pando, Joel and Jo-An Ravitz, Elizabeth M. Rhone, Mr. and Mrs. Ronald Ringsrud, Mr. and Mrs. Richard Roeder, Linda C. Ruhland, Robert A. Sandler, Mrs. Shirley Shipman, Mr. and Mrs. Bruce Stern, Mr. and Mrs. Ian White-Thomson, Ralyn and Nathan Wolfstein, Mr. and Mrs. Robert K. Wrede, and Daniel J. Ziv.

Fellows enjoy a year of adventures in collecting, nature, and discovery with the museum's most active support group. For information on joining the Fellows program, please call the Development Office at 213/744-3307.

CORPORATE SUPPORT. A series of luncheons for the corporate community kicked off in June with a program focused on **Sharks! Fact and Fantasy**. Merlin Olson, who narrated the exhibition video, and Lorraine Gary, star of *Jaws*, were special guests. The luncheons will continue in the fall, funded in part by a generous gift from *California Business* magazine.

The *New York Times* will sponsor the opening festivities for **Gifts from the Great Land** in December 1990. This special exhibition of costumes, weapons, art, and other artifacts from the Northwest Coast and Alaska comes to the Natural History Museum from the National Museum of Finland. (Museum members at the \$100 Patron level and up will share in the opening festivities.)

Red Lobster Restaurants became a national touring sponsor for **Sharks! Fact and Fantasy**, initiating a lively promotional campaign for the exhibition.

The museum welcomes the following new Business Associates: Gibson, Dunn & Crutcher, Mother's Cake & Cookie Co., The New York Times, and Pinkerton Investment Company.



STRANGLERS IN PARADISE

Sometimes a Nuisance, Figs Are Among the World's Most Spectacular Trees

by WAYNE P. ARMSTRONG

Photographs by the Author

Of all the trees on earth, the figs (*Ficus*) certainly have the most bizarre growth forms and the most ingenious method of pollination. Imagine a tree with numerous snakelike aerial roots growing downward from the limbs, a massive, buttressed trunk with huge surface roots spreading in all directions, and a peculiar aggressive growth habit that literally strangles other trees. Although most people are familiar with the Old World edible fig (*F. carica*), the vast majority of fig species grow wild in tropical regions of the world: their unmistakable growth form resembles the background scenery from a *Tarzan* movie. Several unusual species were planted in Florida and southern California near the turn of the century and include some of the most spectacular trees in parks and botanical gardens. Unfortunately, some of these introduced species have proved to be a nuisance in humid regions of the United States.

Ficus, a member of the diverse Mulberry family (Moraceae), is one of the largest genera of woody flowering plants and contains approximately 1,000 different species. It is rivaled in size by only a few other genera of trees and shrubs, such as *Acacia* (700+), *Eucalyptus* (600+), and *Cassia* (500+). With the exception of the Hawaiian Islands, practically every tropical continent and major island group has one or more indigenous (native) species of fig. In fact, the tiny island of Barro Colorado, located in the Panama Canal Zone, has seventeen native species. This is remarkable considering that the island has an area of only six square miles. Even more remarkable, virtually every fig species has its own unique species of wasp pollinator (see box page 37). The wasps are housed throughout the year inside the fig's hollow fruits (called *syconia*) in one of nature's most amazing symbiotic relationships between a tree and an insect.

In their native tropical habitats, many figs are called "stranglers." The sticky seeds are dispersed by a variety of fruit-eating birds and bats. Seeds germinate high on the moist branches of rain forest trees, sending numerous aerial roots to the ground. Like botanical boa constrictors, the roots gradually wrap around the host's limbs and trunk, crushing the bark and constricting vital phloem and cambial layers. The fig's root network, which resembles a tangle of writhing snakes, also fuses together (anastomose), forming a massive woody envelope encircling the host. Expansion of the host trunk as it grows in

*Strangler figs even grow on the arid shores of the Gulf of California. The *Ficus palmeri* grows near Juncalito (just south of Loreto).*

*Opposite page: The aerial roots of *Ficus palmeri* covering the surface of a boulder in southern Baja California. The roots eventually fuse into a massive woody trunk.*



girth may accentuate the death grip and subsequent girdling process. Eventually the host tree dies of strangulation, and the strangler fig stands in its place. In many cases the host tree may actually succumb from shading and root competition rather than strangulation. When strangler figs start in the ground, as in cultivation, their trunks develop from the ground upward like more "conventional" trees.

Several exotic fig species, such as the commonly cultivated Benjamin fig (*Ficus benjamina*), Indian laurel fig (*F. microcarpa*), rustyleaf fig (*F. rubiginosa*), and Moreton Bay fig (*F. macrophylla*), often develop as stranglers with numerous aerial roots in their native habitats of Malaysia and tropical Australia. Due to the introduction of wasp pollinators, some of these commonly grown strangler figs in southern California produce viable seeds; however, it is generally too arid for them to develop epiphytically on other trees.

In humid southern Florida, several species of Asiatic strangler figs commonly develop epiphytically with numerous aerial roots. The sym-



A massive Moreton Bay fig (*Ficus macrophylla*) in Balboa Park, San Diego, one of the most spectacular trees in southern California. In its native habitat of tropical Australia, this species develops as a true strangler fig.

Opposite page:
An unusual strangler fig (*Ficus aurea*) that has completely engulfed the trunk of a cabbage palm (*Sabal palmetto*) in the Florida Everglades.



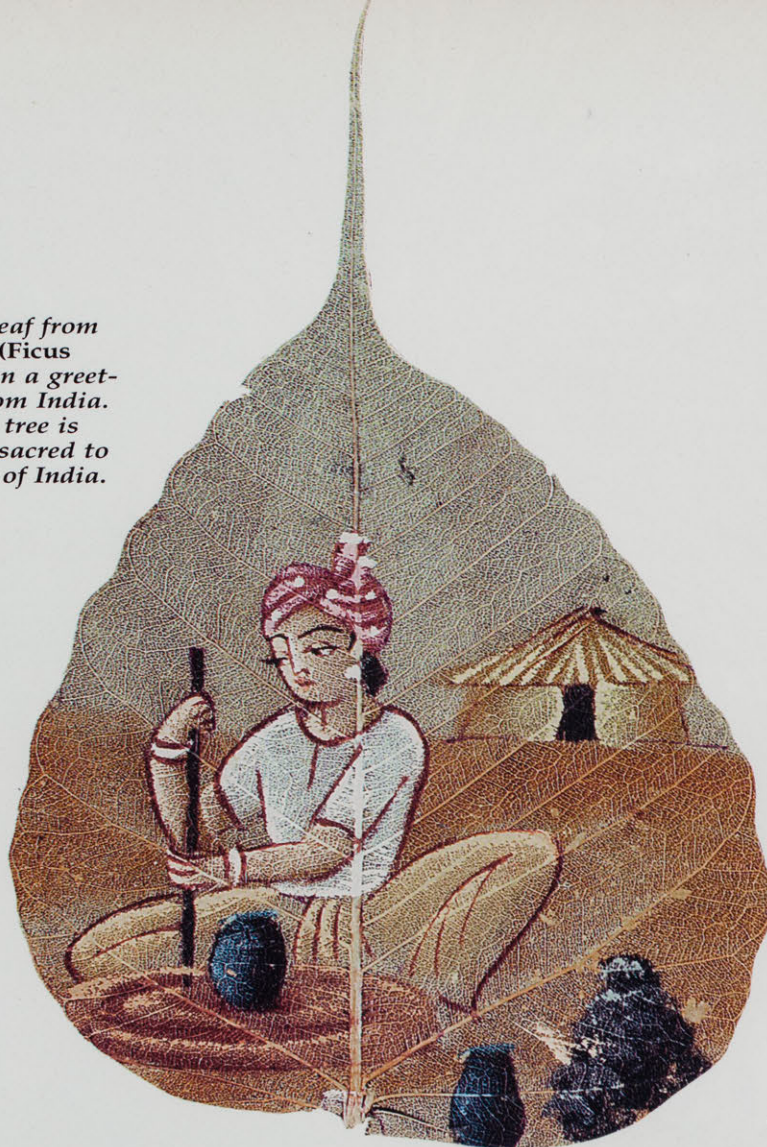
A strangler fig (*Ficus aurea*) tightly wrapped around the trunk of a bald cypress (*Taxodium distichum*). Although the bald cypress appears to be relatively unharmed, its trunk is becoming deeply indented due to the powerful fig roots.

biotic wasp pollinators have also been introduced in Florida for these exotic figs, resulting in prolific seed production. As with many other naturalized alien plants, the original gardeners probably did not realize that their "harmless" plantings would eventually pose a threat to valuable cultivated and native plants. Much to the chagrin of citrus growers, several exotic strangler figs have now attacked orange and grapefruit trees. In addition, two native Florida strangler figs (*F. aurea* and *F. citrifolia*) commonly attack palms, bald cypress, oaks, and many other trees in the Everglades and Keys. Due to the lack of an outer cambial and phloem layer, palms can generally survive the death grip of a strangler fig—that is, until they are gradually shaded out.

Florida strangler figs also wrap around masonry walls and other stationary objects, including historic East Martello Museum near Key West Airport. The original structure was East Martello Tower, a sturdy brick fortress constructed in 1862. One crumbling old brick wall in downtown Key West is actually being held together by a network of fig roots. Throughout Key West fig seedlings readily germinate in cracks and crevices of old buildings, gradually sending a weblike mass of aerial roots down the walls to the ground. Some residents of the Coral Gables area consider the Asiatic banyan-type figs to be a nuisance and potential menace. The massive, spreading roots of these enormous trees buckle pavement and concrete swimming pools, plug drainage and sewer lines, and pose a serious threat to underground utilities. On a recent botanical field survey to Florida my party was given the name "fig busters" as we toured several cities in search of strangler figs!



A painted leaf from the bo tree (*Ficus religiosa*) on a greeting card from India. This lovely tree is considered sacred to the Hindus of India.



Strangler figs are common throughout the Caribbean and tropical Americas. In fact, the island of Barbados is supposedly named for a common strangler fig (*F. citrifolia*), which has abundant aerial roots that often give it a "bearded" appearance. The names *higuero* and *higuerón* as well as *matapalo* (tree-killer) are commonly given to the wild figs, but the term in more general use in Central America is *amate*. Both Aztecs and Mayans used bark from native strangler figs to make a kind of paper for the original Mexican codices. The paper was called *amátl* in Náhuatl and *copó* in Mayan. Thin strips of bark were pounded with a stone until a sheet of paper resulted, a process not unlike the production of papyrus paper by Egyptians. Fig trees figure commonly in poetry and romance of Central America, and the trees become intimately associated with daily life and are regarded with affection. The *amate* is called the national tree in El Salvador. Village markets are often held in the ample shade of a giant fig tree or a huge kapok (*Ceiba pentandra*).

In Yucatán and Central America, strangler figs are an important component of the tropical forest, providing food and habitats for a variety of ani-

mal species. They are also a major factor in the destruction of Maya cities. Seeds dispersed by fruit-eating birds and bats germinate in crevices high on the walls of buildings. The powerful roots force their way between stone blocks, gradually reducing massive vertical walls to rubble. Many ancient cities still remain partially or completely covered by huge strangler figs and other vegetation. In Guatemala, the spectacular pyramids of Tikal resemble islands of stone in a verdant sea of tropical forest. A steep trail ascends one of the tallest pyramids, winding through a labyrinth of fig roots that serve as convenient steps and hand rails.

Although not a typical strangler, a native Baja California fig (*F. palmeri*) has seeds that germinate on vertical rock walls in remote canyons. A similar species (*F. petiolaris*) grows in rugged arroyos and mountains of mainland Mexico. These unusual figs are undoubtedly isolated remnants from a widespread tropical flora that covered parts of Mexico during the Tertiary Period (70 million years ago) when Baja California was contiguous with the Mexican mainland. The seedlings of both species develop an unusual swollen (caudiciform) base containing water storage tis-

FIG WASPS

Part of One of Nature's Most Amazing Symbiotic Relationships

Strangler figs produce the most unusual of all fruits. They are called *syconia* and are essentially inside-out flower clusters (inflorescences). The syconia are hollow, fleshy structures composed of modified stem (peduncular) tissue lined on the inside with hundreds of miniature male and female flowers. The flowers are pollinated by a tiny female agaonid wasp (family Agaonidae) that squeezes through a small opening (ostiole) in the green, immature syconium. As she forces her way through the dense, overlapping scales lining the ostiole, the wasp's wings often break off and protrude from the opening. The tightly overlapping scales serve the purpose of brushes—removing bacteria and fungal spores that might infect the moist syconium. Timing is crucial to the wasp—if she waits too long, the entrance hole seals over as the syconium begins to enlarge. Once inside she has the bewildering task of laying an egg inside the ovary of each female flower. She goes from flower to flower, inserting her threadlike egg-laying device (called an ovipositor) down the slender style of each flower. During this process she also pollinates the flowers by transferring pollen grains from paired pollen baskets (corbiculae) on the underside of her thorax to the receptive stigmas. Since pollen-bearing male flowers mature several months after the female flowers are receptive, fresh pollen must be carried into the syconium by the agaonid wasp.

Fig syconia have two kinds of female flowers: short-style flowers that the wasp can easily lay an egg in and long-style flowers that are too long for her ovipositor. Each egg hatches into a larva that feeds on the seed tissue (endosperm) inside the short-style flower. The long-style flower does not contain a hungry wasp larva and consequently develops a seed. This clever strategy ensures that at least some of the flowers will produce seeds to perpetuate the fig tree. Of course, future generations of fig trees also ensure the survival of the fig wasp. This remarkable partnership apparently was established more than 100 million years ago, when dinosaurs roamed the earth.

After two or three months, the larvae mature into adult male and female wasps that mate inside the syconium. Soon after mating the wingless males chew circular exit tunnels in the syconium wall. The winged females escape through the exit holes and fly off in search of another receptive syconium in which to lay their eggs. Before exiting each female deliberately packs her pollen baskets with pollen from male flowers that have now matured—in one of nature's most complex examples of instinctive behavior and exquisite synchronization with floral maturation. The male wasps remain in the syconium and soon die in their birthplace, the only home they have ever known.

The presence of remarkably specific pollinator wasps probably accounts for the lack of hybridization between many strangler fig species, even though they grow close together. With an abundant supply of specific pollinators for each tree, several species of figs can coexist side-by-side, a phenomenon known as "species packing." Fig wasps apparently do not enter the "wrong" syconium, possibly due to a special chemical attractant for each species of wasp. As with most complex biological phenomena, there are always exceptions. Some syconia may contain more than one species of wasp, including "bogus" fig wasps of the families Torymidae and Eurytomidae, which have very long ovipositors. Some torymid wasps can even oviposit through the syconium wall without pollinating the fig. The torymid larvae may be seed predators, parasites of the fig wasp (agaonid) larvae, or inquilines—coexisting with, but not necessarily harmful to the fig or its symbiotic wasp. The presence of bogus fig wasps and natural pollinator wasps in the same syconium is a complex and perplexing coevolutionary problem in fig biology.

In cultivated edible figs (*Ficus carica*), wasp-producing short-style flowers and pollen-producing male flowers are produced on "male" trees called caprifigs. Female trees produce only long-style female flowers. Most varieties of *F. carica* are parthenocarpic, that is, they develop edible seedless syconia without pollination. Some varieties, such as the delicious Calimyrna figs, are wasp pollinated, but you won't get a mouthful of wasps when you eat one. The syconia contain all long-style flowers and the female wasp is unable to lay her eggs inside them. However, she does pollinate the figs and this results in mature seeds—and produces the crunch and superior nutty flavor of your Fig Newtons!



Gravid (egg-laying) female wasps entering the ostioles of small receptive syconia (hollow fruit) on a rustyleaf fig (Ficus rubiginosa).



A mature female wasp (Pleistodontes imperialis) emerging from the ovary of a short-style female flower inside the syconium of a rustyleaf fig (Ficus rubiginosa).



Mature syconia of the Asiatic strangler fig (Ficus microcarpa) with exiting female wasps (Parapristina verticillata). Because of the introduction of symbiotic pollinator wasps and abundant seed production, this naturalized strangler fig has become a serious pest in urbanized areas of southern Florida and a potential threat to agricultural areas.



"Bogus" fig wasps (family Torymidae and Eurytomidae) have an unusually long ovipositor. Although they do not benefit the fig tree, torymid and eurytomid wasps are common inhabitants of New World fig syconia. Their coexistence with natural fig pollinator wasps is a complex and perplexing coevolutionary problem in fig biology.



sue. They survive prolonged periods of drought and then resume growth when water is available. In the Sierra de la Giganta in Baja California, numerous adventitious roots of *F. palmeri* grow down sheer rock walls, eventually fusing into a creamy white trunk resembling a cascading waterfall or lava flow made of wood. In the rugged Cape region, huge surface roots wrap around boulders like a giant vegetable octopus. The taxonomic status of another Baja California fig (*F. brandegeei*) awaits a comprehensive study of the pollinator wasps of these fascinating trees.

The strangler habit is not limited to figs. The pitch apple (*Clusia rosea*) often develops epiphytically on other trees. In Virgin Islands National Park it is often called "strangler fig," but actually belongs to a different tropical plant family, the Clusiaceae or Guttiferae. Dr. Erwin Ting of the University of California at Riverside has discovered that *Clusia* exhibits crassulacean acid metabolism (CAM), a photosynthetic mechanism for conserving moisture previously known only in cacti and other succulents. This apparently aids in the establishment and growth of epiphytic seedlings until their aerial roots reach the soil.

Many tropical figs develop slender aerial roots hanging from the branches; however, in true banyan-type strangler figs enlarged aerial roots extend from the branches to the ground, giving the tree the unusual appearance of being supported by pillars. By this manner of growth the tree is able to spread outward almost indefinitely, and many Indian banyans (*F. bengalensis*) are of immense size and very old. One of the largest trees on record grew at the Calcutta Botanic Garden. It is listed in the *Guinness Book* as the world's largest (spreading) tree crown; it had one thousand prop roots and covered an area of four acres. The canopy of some banyans provides shade for entire villages. Alexander the Great reportedly camped with an army of seven thousand soldiers under a banyan. The Hindus regard the banyan as sacred, for it is said that Buddha once meditated beneath one. Probably the most revered tree in the world is *F. religiosa*, the sacred bo tree of Burma, Ceylon, and India. It is said that Buddha sat under its shade for six years while he developed his philosophy of the meaning of existence. The striking heart-shaped leaves of the bo tree tremble in the slightest breeze like a cottonwood—a legendary tribute to the divine meditations of Buddha. The English name "ban-



At the ancient Maya city of Tikal in Guatemala, strangler figs grow on many of the partially excavated buildings.

Opposite page:
A large Indian banyan (*Ficus bengalensis*) at the Gauguin Botanical Garden in Tahiti. The trunks in foreground are actually large prop roots from the enormous tree in the distance.



At Tikal, strangler fig roots cover some of the huge unexcavated pyramids. The roots serve as convenient steps and hand rails to climb the pyramids.

yan" comes from the *banians* or Hindu merchants who set up markets in the shade of these enormous trees.

Banyans are not limited to India. On the scenic South Pacific islands of Tahiti and Moorea the Polynesian banyan (*F. prolixa*) clings to vertical volcanic cliffs, sending hundreds of aerial roots to the ground far below. Polynesian banyans also grow near native settlements and are considered sacred. In addition to providing shade, they have several interesting uses. Slender aerial roots are picked and used to treat skin cancer and other afflictions. The medicinal properties may relate to the milky sap containing ficin, a strong proteolytic (protein digesting) enzyme that can apparently also rid the body of parasitic worms. (The milky latex from several Central American strangler figs has also been used as a vermifuge.) The inner bark was also pounded into tapa cloth, a source of clothing for native Polynesians.

An unusual use for banyan-type figs of the Sikkim-Himalaya region is as living bridges across streams and gorges. Aerial roots from fig trees on opposite banks are tied together and

then fuse and thicken. Another remarkable story comes from the Transvaal region of Africa. One traveler tells of a Bakone village with seventeen conical huts built above the reach of lions on the limbs of one gigantic fig tree.

In spite of their sinister common name, strangler figs are one of the most important components of tropical forest ecosystems. During the day hundreds of animals feed on the sweet fruits, including many species of pigeons, parrots, hornbills, toucans, and monkeys. As night falls, the day foraging shift retires and flocks of fruit-eating bats descend upon the branches. Fig trees typically produce three or more crops of fruit a year, providing food throughout the year when other sources are in short supply. The fleshy, juicy fruits are full of small seeds that readily pass through the digestive tract of animals. In fact, the purgative effect of fig fruits on the bowels encourages its seeds to be widely dispersed—good strategy for an epiphytic opportunist. In addition to the prodigious fruit source, hundreds of animal species make their homes in the hollow trunk where the strangler fig has enveloped the decayed host tree. The cavities provide housing for myriad creatures, including geckos, frogs, anolis lizards, bees, wasps, beetles, and ants. These trunk dwellers in turn provide an additional food source for higher levels of the fig food web.

Although several species of wild figs are native to southern Florida and Baja California, fossil evidence indicates that strangler figs once grew wild in California about 40 million years ago, in a tropical forest much like present-day Yucatán. Today figs are represented by several spectacular Asian and Australian trees originally planted by farsighted gardeners with a vision, long before most of us were born. With a warming climate trend during the next ten thousand years, accompanied by an increase in humidity and rainfall, the progeny of some of these exotic species quite possibly could assume their inherent epiphytic growth habit in southern California. Alien strangler figs in California might some day prove to be a horticulturist's nightmare, as they are today in Florida.

Wayne P. Armstrong is Professor of Biology at Palomar College in San Diego County. He has written for Pacific Discovery, Madrono, Environment Southwest, and Fremontia as well as TERRA. His research interest is the taxonomy of the Lemnaceae (duckweed) family.

Adventure with the MUSEUM TRAVEL PROGRAM



Sea of Cortez, Baja California.

ELMER E. NELSON

Everglades and Florida Keys

January 25–February 3, 1991

Explore coral reefs, barrier islands, mangrove swamps, and sawgrass prairies in Everglades National Park. Tour John Pennekamp Coral Reef State Park, Big Pine Key State Wildlife Refuge, and Key Deer Preserve. Take an optional seaplane ride to Fort Jefferson National Monument on Dry Tortugas; tour the Ten Thousand Islands area by boat. Photograph herons, otters, and alligators on Sanibel Island; view manatees in the Galoosahatchee River.

\$1,903 plus airfare

Among the Great Whales

February 8–19, 1991

Enjoy Baja California and the Sea of Cortez aboard the 70-passenger *Sea Bird*. Visit Laguna San Ignacio and Bahia Magdalena, where California gray whales give birth to their young. Study the plants, animals, and geology of Baja's pristine desert.

From \$2,800 plus airfare

Winter in Yellowstone

February 6–22, 1991

Discover the beauty of winter in the world's first national park. Traveling by snow coach and sleigh, view the moose, bison, Canada geese, bald eagles, and trumpeter swans attracted to the year-round warmth provided by Yellowstone's geysers and fumaroles.

\$1,148 plus airfare

Tropical Rain Forests of Costa Rica

February 8–19, 1991

Delight in Costa Rica's wealth of unique flora and fauna on this tour led by botanist Bob Gustafson and ornithologist Jim Lewis. Visit Tapanti Wildlife Refuge and the teeming jungle of Tortuguero National Park, where flowering vines and trees house monkeys, sloths, and incredible birds. Also included are the forested mountains of Braulio Carrillo National Park, Poas Volcano, the Monte Verde Cloud Forest, and the mangrove swamps of the Pacific coast.

\$3,016 including airfare

Spice Routes of the Indian Ocean

May 17–June 3, 1991

Sail to remote islands in the Indian Ocean aboard the *World Discoverer*. Visit Mauritius, Reunion, the Comoros, and Seychelles Islands. Explore Mombasa and Zanzibar, along

the east African coast. Spend five days in Madagascar viewing unique wildlife. Optional post-cruise Kenya safari.

From \$5,450 plus airfare

Russian Zoological Tour

June 3–16, 1991

Few have seen Russia's reserves, zoos, and natural history museums. Be among the first. Join us in Moscow for a visit to the Priosko-Terrasny Biosphere Reserve. Tour Chernomora Reserve in the Ukraine and Askania Nova, where endangered species, including Przewalski's horse, are bred. Conclude with visits to many of Moscow's famous museums.

\$3,655 including airfare

Join us for an informative briefing about the Russia tour on Sunday, November 18, at 3:00 p.m. in the museum's Times Mirror Room.

MUSEUM TRAVEL PROGRAM

For more information, write Karen Hovanitz, Natural History Museum, 900 Exposition Blvd., Los Angeles, CA 90007 or call 213/744-3350.





*Cel from Chuck
Jones's Rabbit
Hood, 1949.*

BUGS BUNNY

The Early Years

by STEVE SCHNEIDER

The criteria for greatness in animated cartoons are several. Bugs Bunny easily meets them all: he was the star of his own long-running series of shorts, in this case numbering more than 170; he became the internationally recognized symbol of an animation studio; he has won more popularity polls than anyone cares to count; hit recordings, sheet music, comic books, newspaper strips, and feature films have carried his name; he has not been absent from television for one day in more than thirty years; his mention brings a pleasant tension to the corners of the mouth.

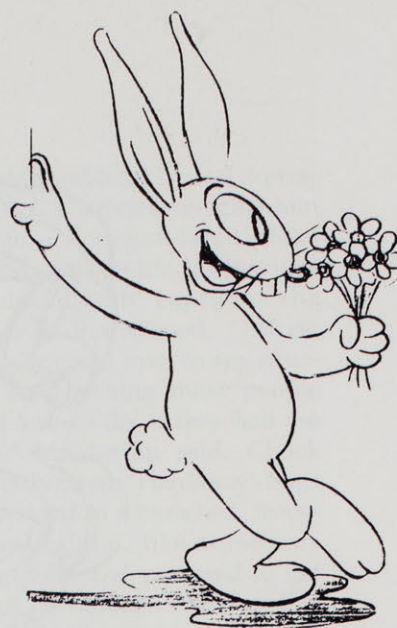
Bugs's first unequivocal ancestor—for the rabbit's parentage has been the source of much debate and controversy—appeared in a 1938 cartoon called *Porky's Hare Hunt*. This black-and-white film was directed by Ben Hardaway and is essentially a retread of the situation established in the first Daffy Duck cartoon, *Porky's Duck Hunt*, which was directed by Tex Avery and released slightly more than one year earlier to a reception so strong that it all but mandated sequels. "Hardaway needed a story," said Warner cartoon director Friz Freleng, "and I remember that he told me, 'I'm just going to put a rabbit suit on that duck.'" In addition, Bob Clampett said that he contributed story and gag suggestions to this first rabbit short. Recapitulating the first Daffy plot, it finds a nincompoop-ish Porky encountering an unpredictable and sassy sprite who whips around the forest spouting wisecracks and irreverence, and who forever confounds Porky's earnest attempts to conform to his role as hunter. If the character seems to be a graduate of the Daffy Duck finishing school, it is no accident: Hardaway received screen credit for writing the second Daffy cartoon, and probably had a hand in the first. (And if both characters seem to anticipate Walter Lantz's Woody Woodpecker, again Hardaway is the key: Two years

later, in 1940, he wrote the first Woody cartoon.)

Physically, the unnamed rabbit is drawn more naturalistically than the final Bugs; totally white, he has long, slender ears and a cottony tail, with just a slight overbite and a coffeebean nose. His speeded voice has a throaty, sloshing tone, somewhat reminiscent of Disney's Goofy, and his cackly laugh would soon be made famous by a woodpecker working across town. (Again, no accident: Mel Blanc, who performed for all the proto-Bugs Bunny's, also originated the Woody Woodpecker voice at Lantz's, repeating this ricocheting laugh.)

Juvenile, aggressive, and purposefully screwy, the rabbit in *Porky's Hare Hunt* has an altogether different personality than the mature Bugs Bunny. Indeed, the rabbit's defining line in this cartoon—"Don't let me worry ya, chief; I'm just a trifle pixilated"—would have made Bugs gag. In fact, it is an echo of the first line spoken by role-model Daffy in *Porky's Duck Hunt*. The Hardaway rabbit hops about frantically, clicks his heels, turns pirouettes, and even spins his ears like propellers to make himself fly.

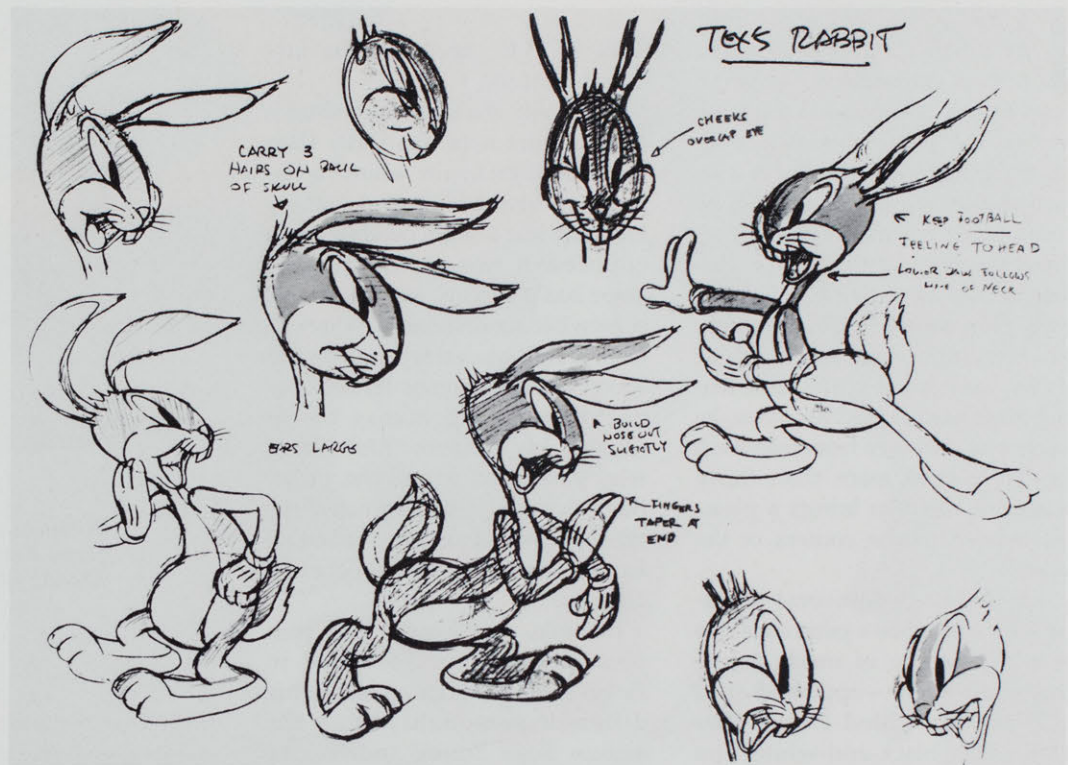
But many of Bugs Bunny's most characteristic bits were first essayed in this film, albeit to different effect. The hunted hare engages in such business as pulling out a picture of his multitudinous rabbit family, so as to appeal for sympathy; drinking "Hare Remover" to become invisible; chomping on a carrot with serene disregard for a nearby menace; faking a death scene; and delivering the filched-from-Groucho line "Of course you know that this means war!"—all of which would be repeated, with drastically different valences, over the next twenty-six years. And it is just these character-determining gags that give the lie to the contention that Warner's rabbit was based on Disney's Max Hare, star of the 1935 cartoon *The Tortoise and the*



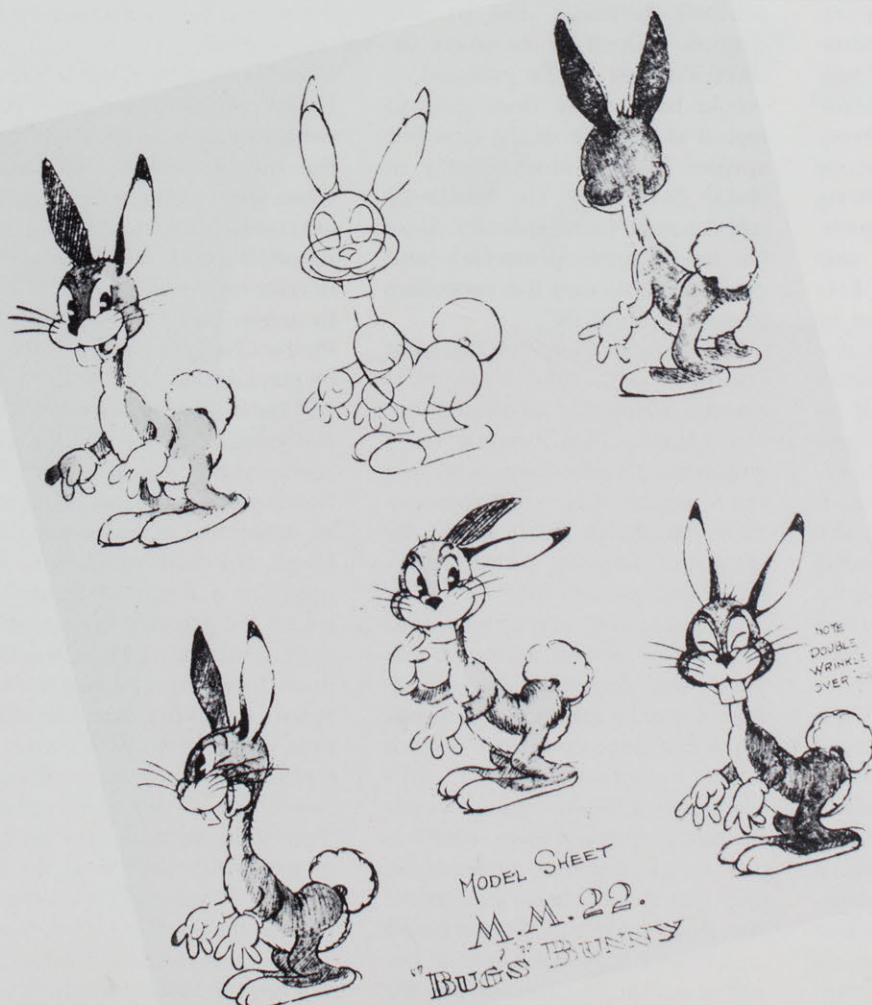
*Animation drawing
from Porky's Hare
Hunt, 1938.*

Hare. Disney's rabbit was a show-offish speed freak, but Warner's bunny was born with his own slapsticky shtick.

Porky's Hare Hunt was a substantial success on the screen—"People were stopping on their way out of the theater to ask the manager when they could see the next rabbit cartoon," Bob Clampett once reported—and so follow-up films in color were undertaken. The next to arrive was Chuck Jones's 1939 *Prest-o Change-o*, in which the rabbit plays against the two naive dogs that the director featured in several cartoons of the time. But Jones concentrated on only one aspect of the Hardaway bunny, that being when he acted like a magician's rabbit. Here, the still nameless hare inhabits a haunted house into which the puppies flee to evade a dogcatcher; the rabbit then subjects them to a series of magician-like stunts—making himself disappear, doing tricks with wands and ropes, performing "nothing up my sleeve" gags—with no apparent motivation beyond exhibiting his mischievous ability to do such things. Physically recalling the *Porky's Hare Hunt* rabbit, Jones's bunny does not talk, although he still has the Woody laugh. Perhaps



Model sheet by
Robert Givens from
A Wild Hare, 1940.



Model sheet by
Charles Thorson
from Hare-um
Scare-um, 1939.

MODEL SHEET
M.M. 22.
"BUGS" BUNNY

the rabbit's only significant contribution to Bugs's development comes when he coolly, archly, arrogantly plants a kiss on one of the perplexed dogs. Another component.

The rabbit character appeared in *Hare-um Scare-um* (1939) and in *Elmer's Candid Camera*, which was directed by Chuck Jones and released in March 1940. In accord with all of Jones's work of this period, the bunny has slowed down considerably in this film; no longer does he uncontrollably caper around the woods, but he is no less malicious, and he trots out yet another sham death scene ("Gimme air! Gimme air!" he groans, with just a wide-webbed hunter's net covering him). But in this cartoon, the rabbit has his first encounter with a schlump called Fudd, who has taken to the green to photograph "wildwife." Wholly unequipped to handle the scalawag bunny, Elmer is driven to attempting suicide by tossing himself into a lake; the rabbit rescues him, makes sure that he is all right, then kicks him right back in.

The one cartoon, however, that must be singled out as the birth of Bugs Bunny is Tex Avery's *A Wild Hare*, released four months later, on July 27, 1940. For Avery assimilated all of the best of the existing rabbit ingredients for this hunt film, while refashioning the character mentally and physically and bequeathing to him the most crucial of his trademark bits. According to Robert Givens, Avery thought that the rabbit "didn't have any personality, and was too cute," and so assigned Givens to draw a reworked model sheet. Accordingly, Givens made the character look hepper and more clever, with a snappier smile and devilish eyes and a more substantial feeling of weight.

But it was what Avery did with these drawings that counted. Most important, Avery jettisoned Bugs's bugginess and made him the brainiest wiseass on the block. Taking a cue from Jonesian slowness, Avery converted the rabbit's new deliber-

ateness into a show of imperturbability under pressure. Whatever the challenge, whatever the threat, Bugs maintained total composure, insouciantly chewing his carrot and thereby defusing those who would harm him, waiting for them to exhaust themselves with their feckless displays of aggression. A perfect master of comic control, Avery's bunny knows that he can take his time. For Bugs has already read the script; he understands that *he* is the star, and therefore is aware of what must happen. He needn't put himself out just for purposes of drama; rather, he will make his intent antagonist do things *his* way.

With wonderful aptness, Avery found ways for Bugs to express his new impudence and impenetrable cool. The first thing Bugs says in this film, upon meeting his would-be assassin, Fudd, is "What's up, Doc?"—a line from Avery's Texas boyhood. Audiences "expected the rabbit to scream, or anything but make a casual remark," Avery told Joe Adamson. "It got such a laugh that we say, 'Boy, we'll do that every chance we get.'" And in *A Wild Hare*, Avery had Bugs kiss Elmer with sufficient frequency to seem positively promiscuous—twice on the mouth and once, with slurping tenderness, on the nose. Even without talking, Bugs gives Elmer lip.

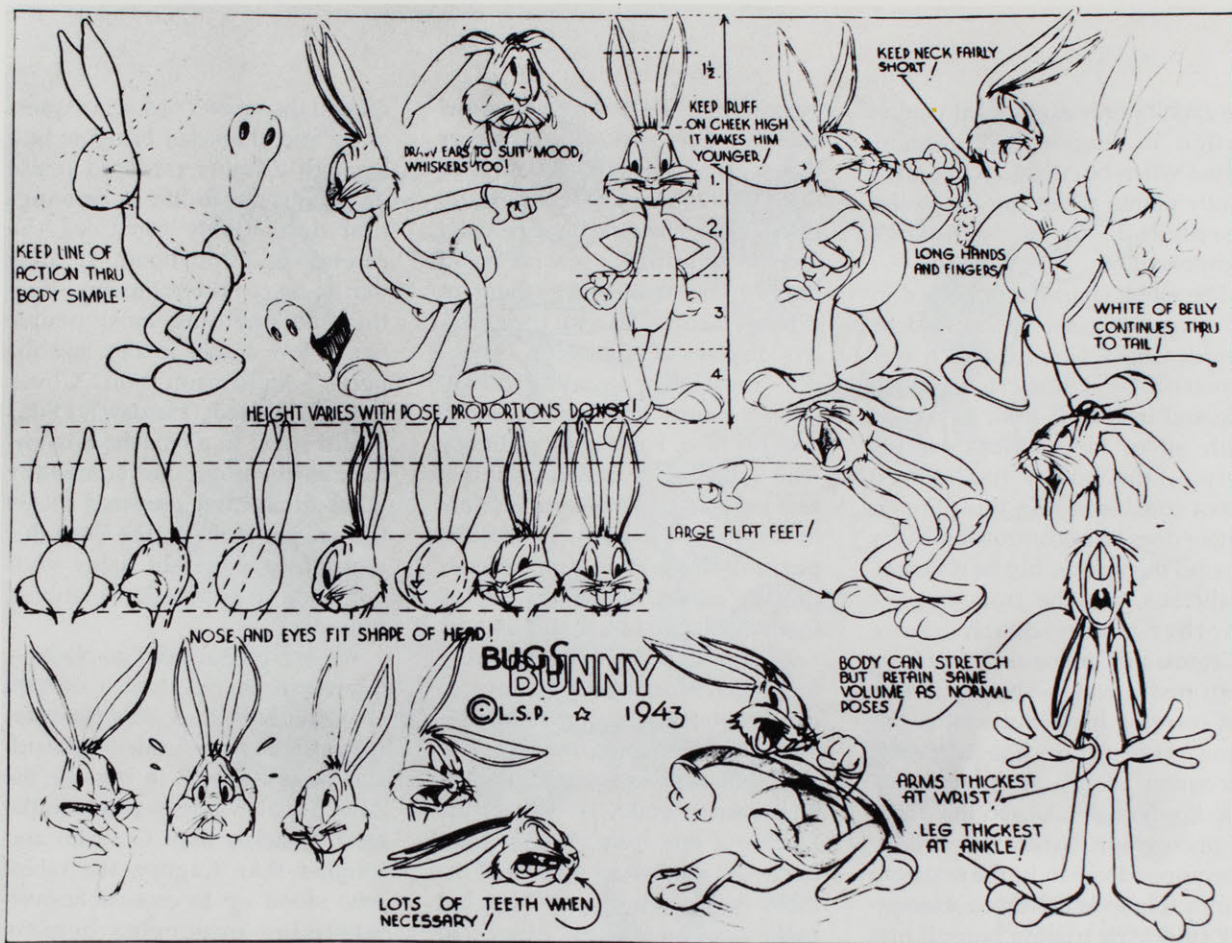
Moreover, it was for this cartoon that Mel Blanc coined Bugs's razzzy voice. "They showed me the storyboard and told me that this rabbit was a real tough little stinker," said Blanc. "So I thought, 'What are the toughest voices I know?' They've got to be Brooklyn or the Bronx"—and, switching to his Bugsian dialect, he added, "So I put the two of 'em tagedda, Doc."

With these pieces in place, Bugs's identity largely solidified—a street-smart scrapper who would always stand his ground. Yet the rabbit's confidence and self-possession were also revealed through other cues. After the release of *A Wild Hare*, Robert McKimson executed a series of model sheets that progressively

refined the rabbit's physical expressivity and character, bringing him through a rather rat-faced phase until he came to life in drawings that definitively captured the essence of Bunnyhood. "I drew him so he could react to any situation, do anything most people would love to do, if they had the nerve," McKimson said. Chuck Jones elaborated: "Hardaway's Bugs would stand in a crouched, ready-to-leap fashion, like somebody who's afraid and prepared to get the hell out of there. The Bugs that evolved stood upright, a guy who's not going to go anyplace—sure of himself."

Yet Avery's Bugs did go places—anywhere, in fact, that a cartoon character can go. *A Wild Hare* was nominated for an Academy Award, and Bugs went on to become the most popular cartoon player in the land. Quicker than Groucho and tougher than Cagney, the rabbit who stood up to ostensibly overwhelming opponents became America's mascot during World War II. "Bugs Bunny has been loved for over a quarter of a century now, but he has never been loved the way he was during those war years," Bob Clampett said. "Just as America whistled the tune from Disney's *Three Little Pigs*, 'Who's Afraid of the Big Bad Wolf?' in the dark days of the Depression...so, Bugs Bunny was a symbol of America's resistance to Hitler and the fascist powers. In both instances, we were in a battle for our lives, and it is most difficult now to comprehend the tremendous emotional impact Bugs Bunny exerted on the audience then."

In 1953, Jones directed a cartoon that synthesizes virtually all of the motifs that sustained the later bunny series. *Bully for Bugs* takes place in Spain, a locale that is both exotic and incongruous for a rabbit; Bugs has burrowed his way into a bullring there, popping out and proffering the scantest of excuses: "I knew I shoulda taken that left turn at Albuquerque." He then crosses paths with a quintessential



The full grown bunny: the 1943 model sheet by Robert McKimson, then one of Bob Clampett's principal animators.

antagonist, a tremendous and bel-
lowing black bull who snorts
sparks and smoke and sharpens
his horns on a grindstone. The
muscular bull soon charges up
behind the rabbit and begins huff-
ing and puffing. "Stop steamin' up
my tail!" Bugs protests. "Whadd-
aya tryin' to do, wrinkle it?" The
bull backs off and butts Bugs far out
of the ring and, in midair, "Of
course you realize this means war."
Between frames, Bugs becomes
Juan Belmonte, the legendary
matador; and, before long, the bull
is receiving a boulder between the
horns and Bugs is taking bows.

How did so finely realized, so
classically correct a cartoon come
about? As Jones told Peter Bog-
danovich: "One time, I was draw-

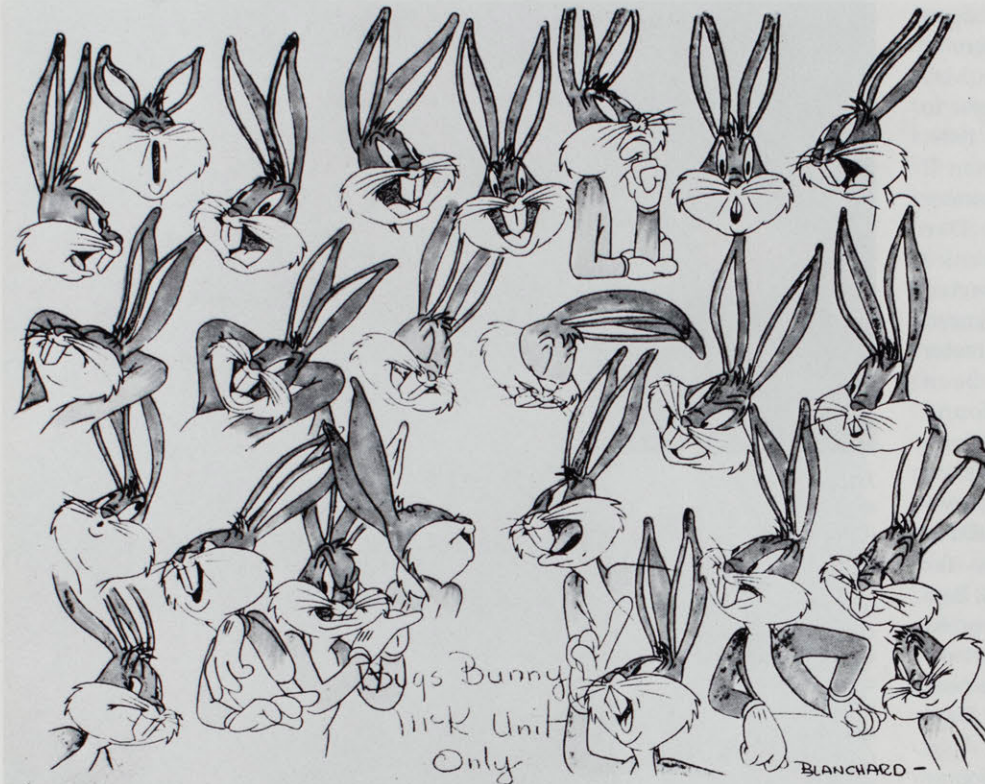
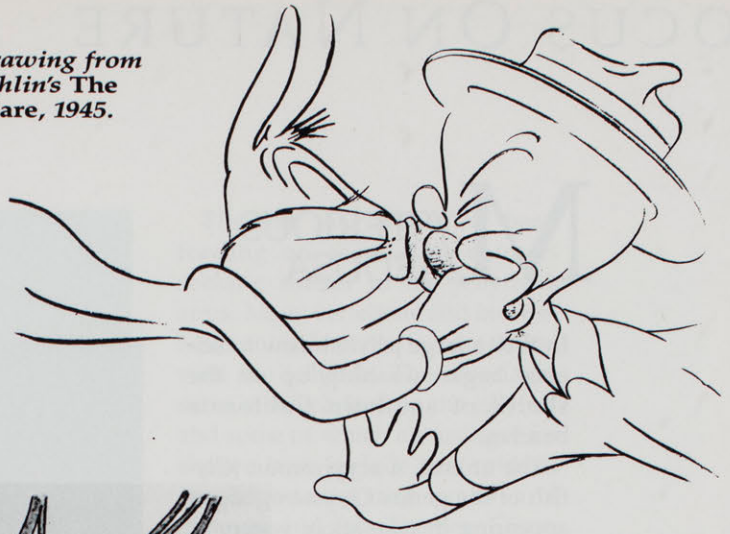
ing a bull—just for the fun of it—
when [Warner cartoon producer
Eddie Selzer] came in, looked over
my shoulder, and said, 'I don't want
any bullfights—bullfights aren't
funny.' Now, I had no intention of
making a bullfight picture, but
after he said that I went ahead."
Like his long-eared hero, Jones
doesn't fight, he fights back.

Almost from the outset, the
Warner 'toonsmiths knew they had
a star in Bugs Bunny, and treated
him appropriately—having other
characters refer to him admiringly
in their cartoons, letting him make
cameo appearances, designing a
brassy capital-letter logo for him to
recline on at the beginning of his
cartoons. And in several instances,

the Warner directors treated Bugs
as if he was an autonomous entity,
casting him in roles in which he
played off of his own celebrity
status.

Bob Clampett's very funny *What's
Cookin', Doc?* (1944) finds the rabbit
beaming with confidence that he is
going to win that year's Oscar—an
award he had not yet achieved.
After a narrated live-action mon-
tage of sites in Hollywood and
scenes from the Oscar ceremony,
the film cuts to the animated Bugs,
sitting in clover at a swank table,
greeting several of his good
friends—Katharine Hepburn, Bing
Crosby, Edward G. Robinson—by
doing overbaked impersonations of
them. But when the Oscar is even-
tually given to James Cagney, Bugs

Layout drawing from
Frank Tashlin's *The
Unruly Hare*, 1945.



Model sheet by Jean
Blanchard for the
Robert McKimson
unit, c. 1947. Poses
from this sheet
appear in *A Lad in
His Lamp*, 1948, and
elsewhere.

is crushed; "It's sab-o-tah-gee!" he hollers, and petitions the crowd to reconsider. Finally, to prove his worthiness, Bugs whips out several cans of film to show the Academy "some of my best scenes"—footage from his past cartoons (although the projection mistakenly begins with a "Stag Reel" that Bugs shrieks at and rushes to the screen to cover).

It would take another fourteen years for Bugs to persuade them. For with Friz Freleng's 1958 *Knighty Knight Bugs*, the rabbit won his first and only Oscar. The film situates the bunny in the role of King Arthur's court jester, endeavoring to rescue the fabled "Singing Sword"—a quivering blade that makes like a soprano—from Black

Knight Yosemite Sam. It is a pleasant cartoon, and the acknowledgment was most welcome by the studio; yet it does seem regrettable that the Academy never cited any of the very many truly stellar bunny cartoons that preceded this choice.

Yet there is some justice in the cartoon universe, for the rabbit eventually did receive his just deserts. On December 21, 1985, Bugs became the second cartoon character (after Mickey Mouse) to be given his own star on the Hollywood Walk of Fame. Before a large gathering of admirers and the press, Bugs was honored with an underfoot plaque in front of 7007 Hollywood Boulevard. Finally, the rabbit has an appropriate canopy for his subterranean home.

Steve Schneider, formerly a television columnist for *The New York Times*, has written on animation for *The Times*, *The Village Voice*, and *Art in America*. This article is an extract from *That's All Folks*, his 1988 book on the history of the Warner's animation studios. Copyright ©1988 by Steve Schneider, reprinted with permission of Henry Holt and Company, Inc. Illustrations courtesy the Steve Schneider Collection. Copyright ©1990, Warner Bros., Inc.

The Natural History Museum has celebrated Bugs Bunny's 50th anniversary with the help of Mr. Schneider and one of the rabbit's creators, Chuck Jones, who is an Honorary Fellow of the museum.

MYSTERIOUS MEDUSA

In 1989 a large jellyfish new to science began washing up on the shores of southern California beaches.

The animal, a scyphozoan jellyfish of the genus *Chrysaora*, began appearing in near-shore waters of our local beaches and bays in May 1989. A specimen was brought to the museum on August 25, 1989, that had been collected by Brian T. Hogue (son of Entomology Curator Dr. Charles Hogue) and Dee Golles, both lifeguards at Venice Beach. We immediately suspected that the jellyfish, which measured approximately two feet in diameter across the bell, had not been described previously. We found dozens of the jellyfish strewn along the shore when we visited Venice Beach later that week. Seaside residents and biologists from Malibu to San Diego and fishermen as far south as Bahía de San Quintín, Baja California, Mexico, have reported seeing the unusual jellyfish on beaches, in bays, and offshore near Islas de los Coronados, Baja California.

Until underwater video footage of a school of live jellyfish was provided by Mark Conlin (of Howard Hall Productions), it was thought that the jellyfish consisted only of a dark maroon bell marked by a light tan speckled pattern around the bell margin. The footage showed that the jellyfish has trailing arms and tentacles; in some large individuals they extend approximately fifteen feet behind the jellyfish as it swims horizontally through the water.

This species of *Chrysaora* is probably an offshore inhabitant that for unknown reasons is washing inshore to be beaten against rocky outcroppings. Garibaldis and other near-shore fish were seen feeding voraciously on the jellyfish's arms and tentacles, thereby further restricting their mobility and allowing the currents and wave surges to wash them ashore.

HOWARD HALL



Huge jellyfish sighted off Islas de los Coronados, Baja California, Mexico, provides underwater photographer Mark Conlin with a close view of a new species of marine life. Garibaldis and señoritas (above) feed on the jellyfish's arms and tentacles as it washes ashore in a weakened state.



HOWARD HALL

Focus on Nature is a new TERRA column that will highlight the incredible diversity of animal and plant life still found in southern California. Each issue will feature an example of a different species from the astonishing variety of habitats that surround one of the world's largest urban centers.

The fish may also have been feeding on associated animals seeking shelter in the jellyfish's arms. Many vertebrate and invertebrate animals occur in association with the jellyfish. The associates, some of which feed on the jellyfish and some of which are using it for shelter, may include sea spiders, amphipods, young crabs and shrimps, and fish. The new *Chrysaora* species harbored several invertebrate species that were not known to associate with jellyfish. We think that as the jellyfish become weaker and are brought inshore, they collect various forms of commensal and parasitic marine life as they drag along the bottom toward the shore. These invertebrates are of particular interest to the staff of the museum's Invertebrate Zoology section. The presence of these hitchhikers on the new species of *Chrysaora* may help to unravel mysteries about the distribution of these invertebrate animals and answer questions about their symbiotic behavior.

Any sightings or specimens collected of this jellyfish would be beneficial in understanding more about this new and unusual species. If the specimen can be brought immediately to the museum it should be put in a container of seawater. If not, it can be preserved in 10 percent formalin diluted with 90 percent seawater. If formalin is not available, the animals will keep in seawater for several days. They should be handled with great care. The jellyfish seems to have only a mild sting, but handling with gloves would be recommended. Field data are essential to the usefulness of the sighting and/or specimen. Please make note of the specific location, nearness to shore, time of day, date, water depth and temperature (if known) of the collection site, and the collector's name. You may reach the authors at the museum by calling (213) 744-3450.

Hans G. Kuck
Crustacea Collections Manager

Joel W. Martin
Associate Curator, Crustacea

Q: A few years ago I read that the southern California kelp forests were lost due to effects of El Niño. I never heard any follow-up. Have the kelp forests completely recovered?

A: According to Valerie L. Anderson, Curatorial Assistant and Manager of Algal and Bryophyte Collections, kelp forests are greatly affected by seasonal changes. Winter storms regularly tear out older plants, reducing the kelp's massive canopy. During 1982–84, the oceanographic condition called El Niño dramatically increased winter storms that in turn destroyed many kelp forests in southern California. In addition, the warm, nutrient-poor surface water expanded to a greater depth due to El Niño. This reduced the effects of the usual summer upwelling of cool, nutrient-rich waters. Therefore, any adult plants not dislodged and many juvenile kelp plants, which could have replaced adults that had been lost, were subjected to reduced nutrients as well as water temperatures higher than usual.

Researchers learned that more than the changes in the water were affecting the re-establishment of kelp forests. The type of surface on which they grew—either rocky or sandy—played a part in determining their recovery.

Populations of plants growing on rocks have recovered their pre-El Niño densities. Rocky surfaces provide sites upon which juveniles can grow.

Along the Santa Barbara coast, however, populations grow on a sandy substrate. The anchoring structures, called *holdfasts*, of giant kelp plants in these forests are very large and have played an important role in the maintenance of these forests by providing juvenile plants with protected sites on which to settle in the absence of rock. The great storm activity associated with El Niño destroyed these large, old holdfasts. Additional storm activity since 1984 has made it difficult for the holdfasts to develop again. At best, these populations have recovered to much less than a quarter of their former size. In some of these kelp forests there has been no recovery yet.

The museum's staff members are often asked historical questions, or to identify artifacts and specimens that people have found, purchased, or inherited and animals, plants, minerals, and fossils that they have encountered in their yards or at the beach on

*Portion of a frond of the giant kelp, *Macrocystis pyrifera*, showing the gas-filled pneumatocysts. These floats buoy the plant toward the water surface, where more light is available for use in photosynthesis.*

A STRANGER IN HER NATIVE LAND: ALICE FLETCHER AND THE AMERICAN INDIANS by Joan Mark, University of Nebraska Press. Paper, 428 pages, \$16.95.

Alice Fletcher (1838–1923) was among a small group of anthropologists active at the end of the nineteenth century who shaped the study of anthropology in this country. She was one of the first to recognize the importance of field work for the study of Native Americans. While living on reservations, she developed more than a scholarly interest in the Sioux, Omahas, Winnebagoes, and Nez Percés. She considered herself an advocate for Native Americans, someone in a unique position to help them move toward a better life.

In addition to being a scholar, Fletcher was an employee of the United States

a hike. Housecalls is a feature of TERRA in which the museum's staff will discuss interesting questions that the museum's members and the general public have frequently asked them.

Department of Indian Affairs. She pushed for the assimilation of Indians into mainstream America by supporting the Dawes Severalty Act, which gave land allotments to Indians who denounced allegiance to their tribes. Fletcher believed that the isolation of tribal affiliations increased an individual's dependence on the government and inability to move toward assimilation.

Unfortunately for Fletcher and the Native Americans she came to know, her activism was misguided. Joan Mark's book is the story of a scholar who contributed a great deal to the literature in her field, but whose political actions hurt the people she was trying to help. Mark explains, "Alice Fletcher did not understand Indian culture well enough to know what this abrupt and forced about-face in ways of thinking and behaving would do to the Indians. She did not know that to destroy the culture of a people is to break the spirit of a people." (p. 102)

Mark draws on extensive sources documenting Fletcher's career as an anthropologist, but is unable to turn up information on Fletcher's earlier years. Since Fletcher did not even begin studying Native Americans until she was in her forties, this leaves the first half of her life unexplained. Consequently, the reader never understands what motivated Fletcher to devote herself so thoroughly to working with native Americans.

Despite this limitation, *A Stranger in Her Native Land* is a solid study of Alice Fletcher's career and activism. It also provides an interesting look at her relationships with various people, including her scientific mentor F. W. Putnam of the Peabody Museum of Archeology and Ethnology at Harvard; Jane Gay, her companion and photographer for a time; and especially Francis La Flesche, an Omaha Indian who collaborated with Fletcher on much of her work and lived with her as her son.

Janet Evander
Collections Manager, Seaver
Center



RICHARD C. ZIMMERMAN

FOCUS ON THE WEST

Yosemite Valley is surely one of the most-photographed places in California—if not the world. This photograph, taken by an unknown photographer around the time Congress created Yosemite National Park in 1890, demonstrates that taking photographs in remote places at the end of the nineteenth century was no easy matter. Exposure times were long compared to those made possible by the more sensitive films of today. Cameras and tripods were bulky contraptions that were difficult to set up and move around. Photographs were made on heavy glass plates that varied in size from the mammoth 18 by 22 inch plates used for panoramic shots to the smaller, but still heavy, 5 by 8 inch size. All of this equipment had to be carried into the wilderness by wagon, pack animal, or often on the photographer's back. Realizing the difficulty of photography in the early years can only heighten our appreciation for these photographs.

This photograph is from the Seaver Center's Putnam and Valentine Collection. Putnam and Valentine Studios was one of the leading photographic firms in Los Angeles at the turn of the century, and their work frequently appeared in magazines, books, and promotional literature.



GENERAL PHOTO FILE 6765; PUTNAM AND VALENTINE P874

Focus on the West: Images from the Seaver Center is a TERRA feature that presents the photographic highlights of the museum's Seaver Center for Western History Research. The Seaver Center is rich in photographs and other materials relating to the history of the American West.



TREASURES OF AN ANCIENT CIVILIZATION



From approximately 2000 B.C. to 1500 A.D., the fascinating and complex culture of the Maya flourished in Mexico and Central America. The distinctive and highly intriguing art of this ancient civilization can be enjoyed today in the form of detailed replicas. Made in Mexico, and handcrafted of terra cotta, these figures are from a collection of Pre-Columbian reproductions currently available in the museum's ETHNIC ARTS SHOP.

Call 213/744-3336 for telephone orders or further information.



Chac Mool (6½" high)
19.95

Maya Princess (16½" high)
\$50.00



Baby Carrier (11½" high)
52.00